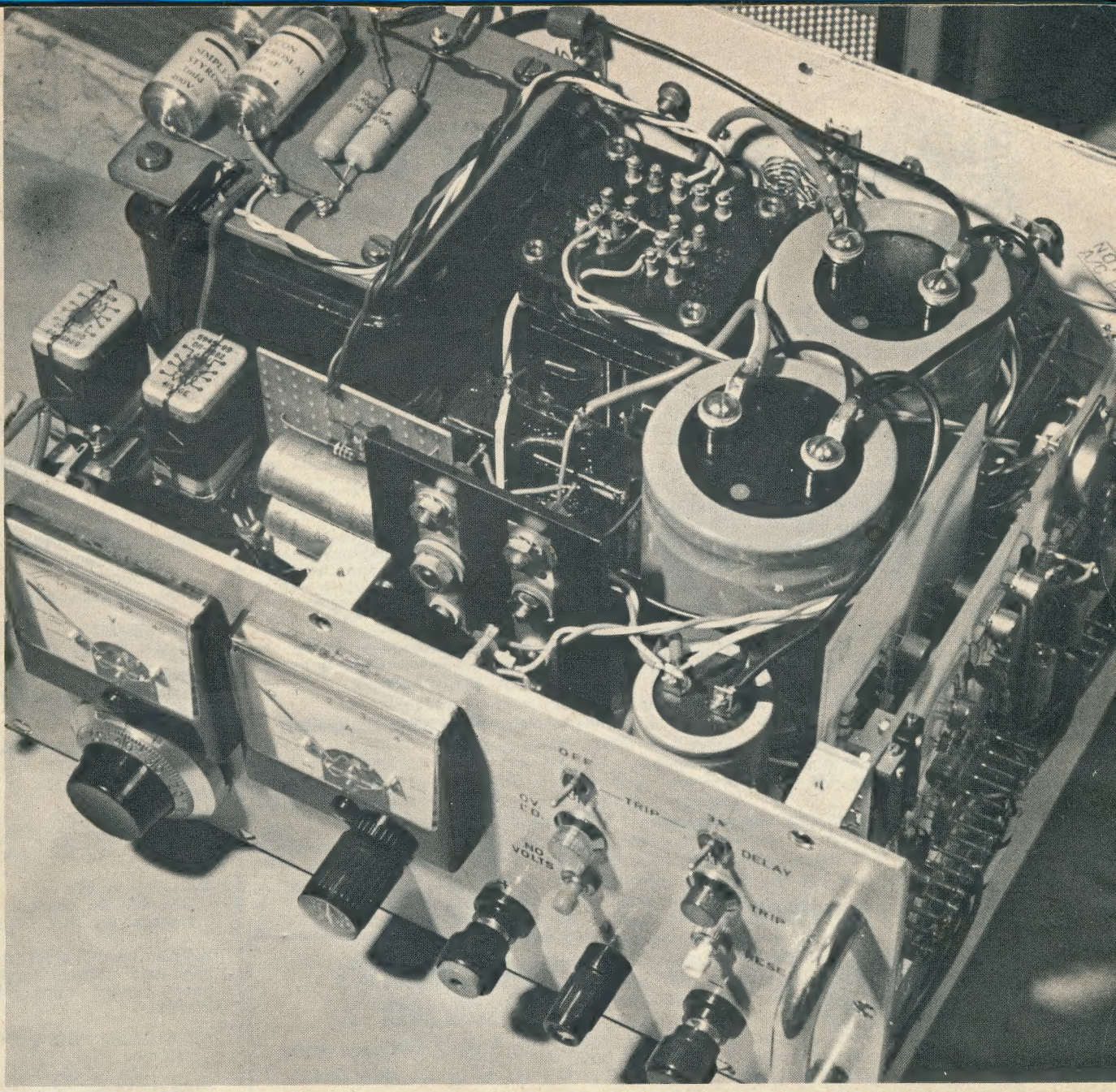
amateur radio



VOL. 43, No. 4 APRIL 1975

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FRONT COVER

The "Experimenters Delight" is a very interesting regulated power supply described in detail on page 5 of this issue. This view shows the general layout of the unit.

JOURNAL OF THE WIRELESS INSTITUTE OF AUSTRALIA

HAM RADIO Suppliers

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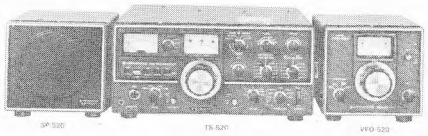
KENWOOD/TRIO TS 520 5 BAND SSB TRANSCEIVER



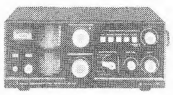
Specifications

Frequency Range: 80 metre band — 3.50 to 4.00 MHz; 40 metre band — 7.00 to 7.30 MHz; 20 metre band — 14.00 to 14.35 MHz; 15 metre band — 21.00 to 21.45 MHz; 10 metre band — 28.00 to 28.50 MHz, 28.50 to 29.10 MHz, 29.10 to 29.70 MHz; WWV — 10.00 MHz.

Mode (Receive only) USB, LSB, CW.
Input Power: 160 watts on 80 to 15 metre band, 140 watts on 10 metre band.
Nett amateur prices:

TS 520 $550.00 with PTT mike, SP 520 Speaker.

COMMUNICATION RECEIVERS



Trio QR666 general coverage communications receiver solid state 550 kHz — 30 MHz 6 bands. 230V/12V.

Price $330

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TRIO MOBILE TR7200G TRANSCEIVER, VHF/FM with crystals for 2 channels **$235**

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Extra crystals **$8.00** extra

1 WATT 2 CHANNEL TRANSCEIVER

with call system. 27.240 MHz, 12 transistor. PMG approved type.

Specifications:

Transmitter — Crystal controlled: 1 Watt input power to RF stage. Operating frequency — Any 2 channels in the 11-metre Citizens Band. Receiver — Crystal-controlled superheterodyne circuit with 455 Kc IF. Antenna — Built-in 60" telescopic whip antenna. Audio Output — 0.8 Watt maximum. Power supply required — 12 volts DC (Eight 1.5 volt DC battery cells). Loudspeaker — 2¼" PM type (built-in) function as microphone on transmit.

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MIDLAND 13-893
SSB/AM, 23 channel, 11 metre transceivers, 12V DC operation **$195**

We also have in stock the following 1 Watt hand-held transceivers for 27 MHz hand phone service which are P.M.G.-type approved:—

STRATOCOM TC10 2 channel with call tone .... **$39.50** ea.

LAFAYETTE HA310 3 channel.... .... **$65** ea.

Additional crystals available for 27.240 MHz, 27.880 MHz and 27.910 MHz at .... **$6.50** pair

27 MHz centre loaded fibreglass cowl mount mobile antenna with base and co-ax **$25.50**

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amateur radio

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FEDERAL CONVENTION

April is the usual month of the Federal Convention. It is in April this year — over the Anzac Day weekend of April 25th, 26th and 27th, 1965.

This year is the first departure from "tradition" which hitherto dictated that the Federal Convention must be held at Easter.

For the first time in many years the Federal Councillors could have taken their families out or maybe could have gone fishing over Easter. Easter will have passed when you read this.

This year's Convention will be in Melbourne and will be held at the Belvedere Motel in Church Street, Richmond. For the first time it will be paid for out of Executive funds.

At the time this is being written it is not known who will be representing each Division but indications are that old friends Neil Penfold from the West and Lawrie Blagbrough from the Sunshine State will be with us. New friends will be with us, probably including Peter Frith from Tasmania, Ed Perkins from the ACT, and Ian Hunt from South Australia. At this moment we have no definite news about the New South Wales delegate. The "host" Division, last but not least, will probably field the same team as last year captained by Russell Kelly, the Victorian Division's President and Federal Councillor.

Most of the business to be transacted at this Convention ought to have been in the system by the end of 1974 if last year's Convention Motions had been properly observed. That this has not occurred is understandable because of the protracted delays in getting the 1974 Convention Minutes out. This arose through a misunderstanding that the Minutes must follow the traditional pattern. The marathon performances in the 1974 Convention would have pushed up the cost of the Minutes if written out in the old manner and in fact this would be unnecessary as the tapes are available and copious notes can be referred to by any Federal Councillor.

Obviously, some of the Agenda items left over from last year's General Business will come up for discussion this year. There are good reasons to believe that a few items from last year will require further consideration not only because there has been insufficient time to finalise some of them but also that some further discussions could be useful in clarifying them and certain others.

New items will, of course, have been submitted one month beforehand as explained in some of the recent Divisional broadcasts but any last minute items could be brought up under General Business if the Chairman concurs.

However, the problem with these items under "A.O.B." is that they rely upon enough time being available for adequate discussions after all the Agenda Items have been cleared away in one working day less this year than in previous Federal Conventions. Last year some were in fact left over.

Whatever transpires, there is every indication that so much of interest to amateurs will be discussed in depth at the Convention that a visit by members in the Melbourne area will help them in understanding what amateur radio is all about.

Better still, why not come and help. Volunteers are needed to help with recordings, photo-copying, transport of delegates and many other essential functions.

If you do not take an interest in the business of the Federal Convention you cannot hope to have your pet complaint aired, let alone discussed.

Perhaps this Convention could be the beginning of a new era in the organisation of the Institute.

THE EXECUTIVE

QSP

EMERGENCY COMMUNICATIONS BY SATELLITE

"Nevertheless the long distance transmission (a walkie-talkie into an old golf umbrella through ATS-3) showed that simple radio gear and a collapsible antenna — plus a space satellite orbiting somewhere overhead — would enable persons in distress to summon help from any point on earth". Part of editorial in Ham Radio, December 1974, before the Darwin disaster.

ENVIRONMENTAL PROTECTION

No responsible person ever has contended that the generation, transmission and propagation of radio communication sginals have any effect whatsoever upon the air, water, or soil, i.e., the environment. The only possible connection with the environment is in the area of aesthetics . . . aesthetics cannot be regulated or controlled by statute, ordinance or regulation because there is no readily definable standard. 'Beauty is in the eyes of the beholder'. Amateur radio has painstakingly developed a body of law over the years (in the USA) which provides that the installation and operation of an amateur radio station, including its absolutely essential outdoor antenna and supporting structure, is a normal and permissible use of residential property and cannot be restricted or prohibited by zoning ordinances and building codes". Part of ARRL submissions to FCC as quoted in QST Dec 1972, p.78/81.

DXCC OF ARRL

ARRL announce a new DXCC Award for CW only for contacts made on and after 1st January 1975. Applications will be accepted from 1st June 1975. ARRL also announce new fees for all DXCC Awards endorsements from 1st June 1975. All new applications will cost $US10.00 (or 56 IRCs) each. Thereafter each endorsement will cost $US2.00 plus postage for the return of QSL cards. From that date the application charge for 5BDXCC will be $US20.00. Basically the charges are intended to cover return postages for QSLs, lapel pin and handling. There is no mention of reductions if you do not want your confirmations returned to you, so if you want your ARRL DXCC Award in future, these are the fees.

3.5 MHz BAND

In Region 3 the 80m band is shown as extending from 3500 to 3900 kHz shared with fixed and mobile services. In Australia the band 3500-3700 is allocated to the Amateur Service and 3700-3900 is allocated to the fixed and mobile service. In India the band 3500-3890 is allocated to the fixed and mobile services and the band 3890-3900 kHz is allocated to the amateur service. A letter from JARL advises that after many years of petitioning the Japanese amateur service has been granted a new frequency allocation from 3793-3802 kHz from 1st January 1975. The WIA 1971 Federal Convention (Motion 71.15.01) passed a motion seeking a band 3790-3800 but nothing further on this has transpired although it was duly put forward. In New Zealand the amateur band extends from 3500-3800 kHz. The 80m amateur band in Region 2 extends from 3500-4000 kHz but for the USA possessions in Region 3 (Guam, Samoa, Wake, etc.) the band extends only from 3500-3900 kHz.

NEW HEBRIDES CONDOMINIUM

According to Kev Magee (ex VK3KM) the whole of the Condominium is now YJ8 as FU8 seems to have been discontinued. Amateur licences are obtainable from the Condominium Post Office at Port Vila against an overseas full licence, provided you are a resident, at 1,000 NH Francs per annum. There appears to be no reciprocity for visitors but anyone interested should write direct to the Condominium Post Master.

SUPPLY OF AR

Many have received the message. AR ceases to be sent out to unfinancials. Because of escalating costs the period of grace in future years could be reduced. AR ceases to unfinancials by means of an automatic function of the EDP; the computer address label is omitted. By the way, in Australia AR only goes to financial members of the WIA and on direct subscription to Libraries, schools and similar organisations. AR is freely available on direct subscription to anybody resident outside the VK area. ■

vertical extended double zepp for 2 metres

John Hassell, VK6ZGF
17 Federal Street, Cottesloe, W.A. 6011

Derived from the old long wire Zepp antenna, the VEDZ cut for two metres becomes an antenna of manageable proportions with a number of useful features.

The VEDZ gives a very low angle of radiation, requires no ground plane, is not critical to adjust and needs only an SWR meter to set up on frequency. The antenna can be fed with 300 ohm TV ladder line giving a cost saving over expensive co-ax.

The Zepp antenna is basically an end fed ½ wave wire. Adding another ½ wavelength and feeding at the centre gives the Double Zepp. Extending the arms of the antenna to 0.64 wavelength causes all the radiation to take place at 90 degrees to the axis of the antenna. Used as a vertical the radiation is omnidirectional and at a very low angle. Extending the antenna further is not recommended, as the radiation pattern breaks up into four lobes as the dimensions tend towards 1½ wavelengths.

The VEDZ, being 1.28 wavelengths over all, is not resonant and presents a high capacitive reactance at the feed point. To bring the antenna to resonance, inductance must be added to tune out the capacitance at the feed point.

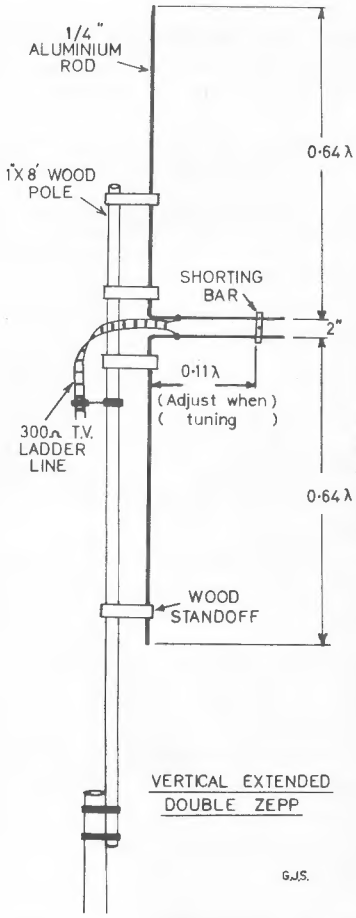
This is done by using a shorted stub less than ¼ wavelength long. This stub will provide the required inductance as well as acting as a matching transformer for the feedline. The stub length works out at 0.11 wavelength. If you add it all up, the stub brings the total length of the antenna to a resonant 1.5 wavelengths (0.64 + 0.64 + 0.11 + 0.11).

The radiation pattern remains the same as for 1.28 wavelengths (which we want) as the stub does not radiate.

CONSTRUCTION

The antenna is constructed from ¼ inch aluminium rod and is mounted on a well painted (to keep out moisture) wooden pole. Wood or preferably ceramic stand off insulators are used. The aluminium rod is cut and bent to the dimensions as shown in the diagram. Cut the rod forming the stub longer than required and trim after tune up. The shorting bar for the stub is made from a strip of aluminium bent to form a clamp and is finally secured with two small bolts.

The stub allows a balanced feed of almost any impedance. Sliding the feedpoint to the shorted end of the stub will give a low impedance match and sliding towards the antenna end gives a high impedance match. The most economical way to feed the antenna is to use 300 ohm ladder line with a balun or tuning unit at the Tx end.



ADJUSTMENT

To adjust the antenna all that is needed is an SWR meter and a transmitter on the required frequency.

The first step is to connect the feeder to the stub at about the centre. Apply power from the transmitter and adjust the shorting bar on the stub until a dip is seen on the SWR meter. This should bring the antenna to resonance. Now slide the feeder up and down the stub for the lowest SWR. Some interaction between the positions of the feed and the shorting bar will be noticed. Juggle both for the best result. An SWR of 1:1 should be possible without too much trouble.

RESULTS

Simple comparison tests showed a considerable improvement in performance over a ¼ wave ground plane and a noticeable improvement over a ⅝ wave ground plane used at this QTH. ■

experimenters delight

Rolf B. Peterson, VK5ZIE
11 Gundawarra Street, Woomera 5720

This is the description of the fruit of quite a few hours of thinking and experimenting. It deals with a power supply which has been found to be a "delight" to use.

How would you like to have available, on your own bench, at a twist of your wrist, any voltage between zero and 50V to the tune of four amperes? Should you not want four amps, there is another knob for your second wrist that will control the maximum to anything between zero and four amps. If your hands are like all left thumbs, and you drop screwdrivers, etc., across the output, this power pack will not mind. It's nicely protected and also affords protection for your circuit. No need to unplug the leads to remove the volts either; there is a little button — touch it and no volts are there in a wink. To get juice back touch button B. If your chosen current limit is exceeded, an amber light tells and the volts go down.

If you wish, and flick a small switch, the "no volts" condition comes up automatically as soon as there is an over current. You may wish again and flick another little switch and the "no volt" condition is delayed two or three seconds. Just enough time to get that telling meter reading. You get a red light with the "no volts" too. Do you like it?

A few more smallgoods; there are two meters to monitor the output, the fuse holder lights up a self-contained neon when or if the fuse goes and, of course, there is a mains pilot neon which glows when the mains are on and the switch is made. And nothing runs blazing hot. The output is obtained at fairly good efficiency (power in over power out). That's all — from the outside.

The "Experimenters Delight" pushing 25.16 x 10^{18} electrons per second through a screwdriver.

In order to have the unit "keep its cool", good efficiency must be built in. A cool running piece of gear will be more stable and last longer. With less self-heating, it can tolerate higher ambient temperatures. To this end a switching regulator is employed. This provides initial stabilisation and converts a high DC voltage to a low one at good efficiency. It does put out some ripple, however, and on its own, therefore, is of limited usefulness. To get a smooth output as well requires further regulation by a linear regulator. That is what was done, ending up with the best of both ideas; low loss pre — and precision post-regulation.

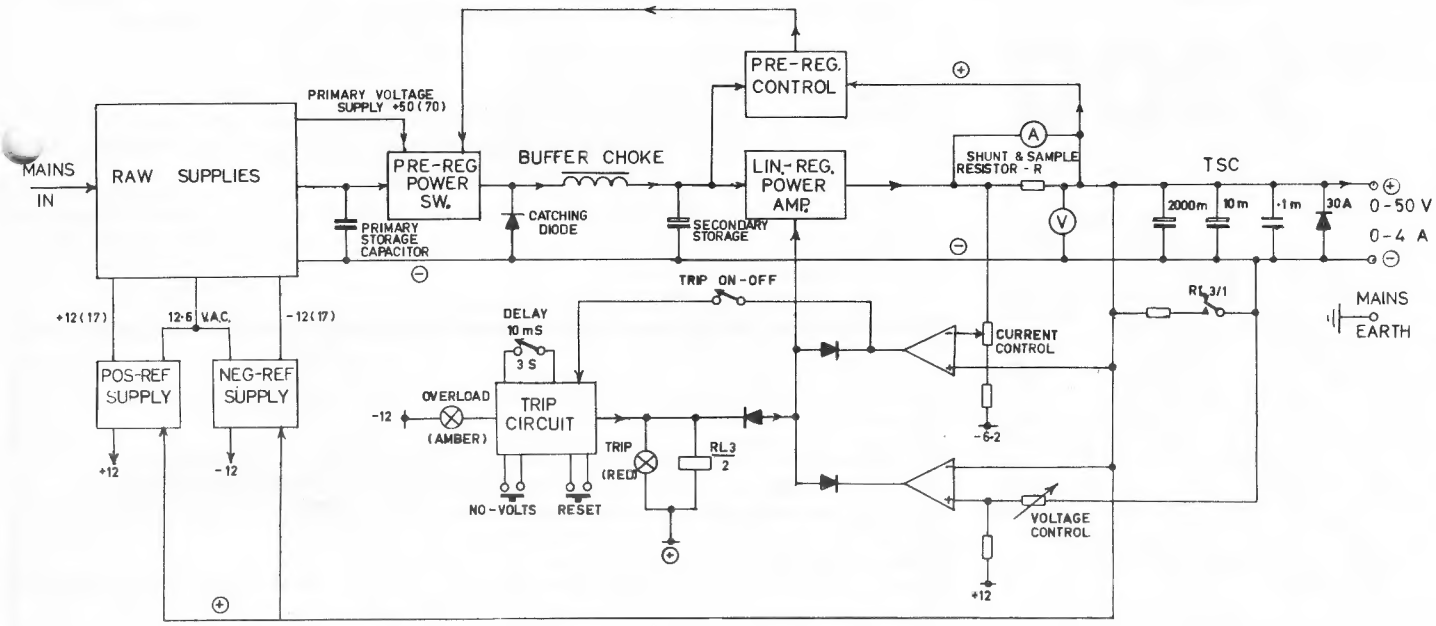
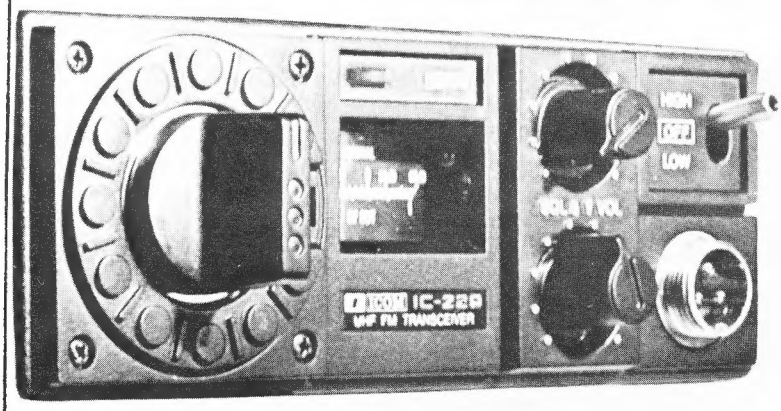


FIGURE 1 BLOCK DIAGRAM GJS

Fantastic Offer

TEN SETS TO BE GIVEN AWAY FREE



NEW ICOM IC22A

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New City Store Open – 125 YORK STREET, (Opposite Queen Victoria Building—100 yds. from Town Hall Station). Phone: 29 1126.

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Features:

- *146–148 MHz in 22 Channels*
- *RF Out 10W/1W Switchable*
- *Mode F3*
- *Deviation 3–16 KHz Adjustable*
- *Dynamic PTT Mic Supplied*
- *5 Helical Resonators in Front End*
- *Receiver Sensitivity 0.4uV, 20dB Quieting*
- *Audio Output 1.5W into 8 Ohms*
- *Power Requirements 13.5V ± 15%*

The IC22A is Icom's new and improved version of the very popular IC22. The IC22A is ideally suitable for home or mobile use. We are offering this unit with 3 channels, i.e. channel 50 simplex and channels 42/54 and 48/60 repeat.

ONLY $200

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Not only is this unit to be sold at a very competitive price but EVERY purchaser will help his Division of the WIA to obtain a FREE IC22A.

For every ten units purchased, Dick Smith will donate one to your nominated Division or Club.These units are ideal for repeater use or WICEN emergency activities.

Yes, by making a large cash purchase of over 100 Icom IC22A transceivers, we have been able to get them at an incredibly low price. The savings are being passed on to you. The normal IC22A price is $199 plus crystals at $9.00 a pair.

We have the IC22A INCLUDING 3 CHANNELS of crystals (normal price $217) for only $200.00 (P & P Insured anywhere in Australia $3.00). PLUS. . .

YOUR PURCHASE HELPS YOUR DIVISION OF THE WIA TOWARDS A FREE ICOM IC22A

Remember:
- All units fully guaranteed 90 days
- Spares available
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PLUS
- Our exclusive satisfaction guarantee – buy one, inspect it. If you aren't satisfied return it for refund less P&P costs. What could be fairer?

PLUS EXTRA SPECIAL 240 V AC – 12 V DC fully regulated power supply, normally $32 – however if ordered with an IC22A – ONLY **$26.00** plus P & P $1.50.

PLEASE USE COUPON TO SPEED DELIVERY

Dick,

Please rush me a brand new, fully guaranteed IC22A fitted with 3 channels of crystals.

Please allocate 10 sales points to the ..... (club or section of WIA). I understand that when my nominated club/division gains 100 sales points you will present them with a FREE fully guaranteed unit.

Name _____ Callsign _____

Address _____

_____

What happens in a switching regulator is briefly this; an excess voltage is generated to cover all contingencies — and then connect the load to this excess for brief periods of time, so that the average power coming through is just right. The same thing happens in automobiles. It's like taking from a 500 gallon tank by the cupful or bucketful. In this power supply, a transistor switch is used to do the connecting of the load, which in this case is the linear regulator, to the excess supply — a capacitor charged constantly by the raw supply to 70 Volts. Have a look at the block diagram now and if you didn't know before, a light should start to glow.

There is a block called "raw supplies", connected to mains and pre-regulator etc. That has in it transformers, rectifiers and such like, putting out raw DC with the ripple, keeping the primary storage capacitor at 70V. This primary storage capacitor (PSC) feeds the secondary storage capacitor and thus the linear regulator, via the transistor switch pre-regulator (PR) and a buffer choke. Contact is made whenever the voltage on the pass transistors in the linear regulator goes below 2.5 volts. The block marked pre-regulator control sees to that. It will signal the power switch to open again as soon as 2.5V difference between output and input of the linear regulator is re-established. The pre-regulator control compares the volts on the secondary storage capacitor (SSC) with a bias on the second input of its op. amp. (741).

This makes the pre-regulator a "switch on demand" type rather than the usual continuously running, pulse width modulated one. It results in a simpler circuit. Of course, when there is a load on, this one is also continuously switching.

Now something about the buffer choke. Its purpose in life is to limit the huge surge of electrons, too much for the transistors, from one capacitor to the next, to lower values. It does this because of its self-inductance. When volts are applied to it a current commences to flow and the coil generates a back EMF which opposes the applied voltage, thus leaving us with only just enough current to keep generating the back EMF. That action causes the current through the inductor to rise from low values to a maximum value at a rate that is higher at first but which decreases with time. The maximum current is set by the voltage across the primary storage capacitor (PSC) and the total circuit resistance. It can reach many amps. In a pure non-saturating inductor with no series resistance, the current would rise from low values linearly to infinity. Practical inductors have resistance, but it can be made quite low. Monitoring the current rise in such a device then, shows the initial increase up to several amps to be quite linear.

One of those in series with our pre-regulator power switch will cause the charging of the secondary storage capacitor (SSC) to be a pleasant affair instead of a violent one. It gives more time to do it. Why an inductor and not a resistor? Because of the lower losses — much lower. A resistor would dissipate $\frac{E2}{R}$ watts.

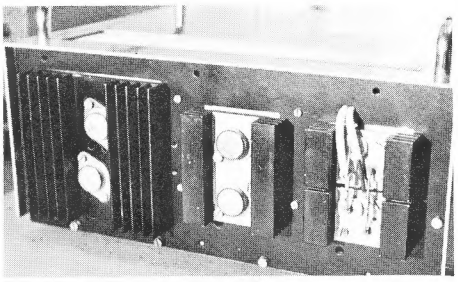
With the primary storage capacitor at 65-70V and the output at 6V, 4A, for instance, that resistance would have to take care of roughly a couple of hundred watts! Our choke has very little resistance and therefore behaves like it should; instead of wasting the extra energy, it stores it, and, when the transistors switch off, the stored energy is pumped into the SSC via the catching diode. It is as if the choke were a generator and charged the capacitor SSC via the diode. Of course, it is only releasing now what was put into it before the pre-regulator switched off.

The electrical parameters of the choke are not all that critical, as long as certain requirements are met. If it is to operate efficiently, it must not go into saturation. The iron core must be a reasonable size. The author's measures 2½" x 1⅞" x ¾" (E — 1 core) and employs a 0.7 mm air-gap. Finding the wanted value of L took some cutting and trying, and starting once more, approximately 90 turns were made finishing up with 3 mH and about 110 milli-ohms. The wire is 19g. and there is enough room for 18g. wire too.

Having spent all available pocket money on the major parts, only 2N3055s and an ordinary 300V 10 amp diode were available for the pre-regulator power switch. It was found that they do not like to switch heavy currents and high voltage at an inaudible rate. They would do it, but they got a bit too warm for comfort — reasoning on the thought of long term reliability. That is why 3mH was chosen and got cooler running. The current in the pre-regulator rises up to about twice the load current. This is caused by the pre-regulator current having to rise to equal the load in order to stop any further discharge of the secondary storage C. It must then rise further to restore the charge to the switch off level which is 2.5V above the output voltage. In the process of doing this, it reaches about 8 amps. or so. The repetition rate and duty cycle adjust themselves to requirements.

The first time a load of 4A was connected onto the output, an electromechanical process was witnessed, with the surety that the pre-regulator operated. The choke made a *lot* of noise. The choke was vacuum impregnated with a plastic floor finish. This was done twice, in a large glass jar with a stiffened lid to which a simple valve was fitted. The choke was immersed, the lid screwed on and the arrangement connected to the intake of a compressor. Lots of bubbling showed escaping air, and upon restoration of atmospheric pressure the goo was pushed into all the nooks and crannies. Each time it was dried in the sun for a day. Now it sings softly instead of screaming.

Back to the block diagram. The box marked "linear regulator power amp" contains a compound emitter follower which is driven via an OR gate by a precision



Rear view of the unit showing, L to R, linear regulator, pre-regulator, and main 50V rectifier.

op. amp. type 777. 471s or 709s may be used also. The 777 was selected particularly as it did not cost all that much more than the others. It also does exhibit more stability. Using this amp., the thermal drift is mainly due to the reference drift. Monitoring the output volts and the reference shows that both have almost the same temperature co-efficient. Only two decimal places could be checked after zero on 50V out.

No special tricks are used to stabilise anything in this supply apart from staying clear of obvious layout and wiring errors. The voltage control amplifier compares the output volts with a reference and does any necessary adjusting. A 3 amp. load causes a voltage drop of 3 mV. This means an internal resistance of 0.001 ohm (on DC anyway). If you look onto the left side of the block diagram you will find two reference supplies. These are complete 12V regulators of conventional design except perhaps for the peak voltage supply in each, which feeds the first emitter follower and the error amplifier collector via a constant current source (CCS). Makes it quieter and it can operate on slightly lower voltage. The two blocks put out +12V and —12V respectively, which are used as references and also as op. amp. supplies. The zero point for them is not 0V, but the positive output rail. In other words, the references "ride" on the output. Connection is made at the output terminal.

An important point here

A whole bunch of solderlugs have been provided and are connected directly to positive and negative output terminals respectively, as reference points. So anything that you find on the circuit diagram, which is connected to positive output (marked +) or negative output (—) goes directly to these two bunches and not to any other convenient point. There is one exception, and that is the negative rail from the raw supply and the wires from the pre-regulator. They have a separate gathering point and that is connected to the 2000 micro-farad output capacitor, which in turn connects to the negative "bunch". For the negative main rail which is mentioned as an exception and its positive counterpart, heavy wire is used — 70 x .007.

Back to the reference. The positive 12V is used for voltage control and the negative 12V for current control. In each case a resistive divider is used which is adjustable from the front panel. It puts a bias

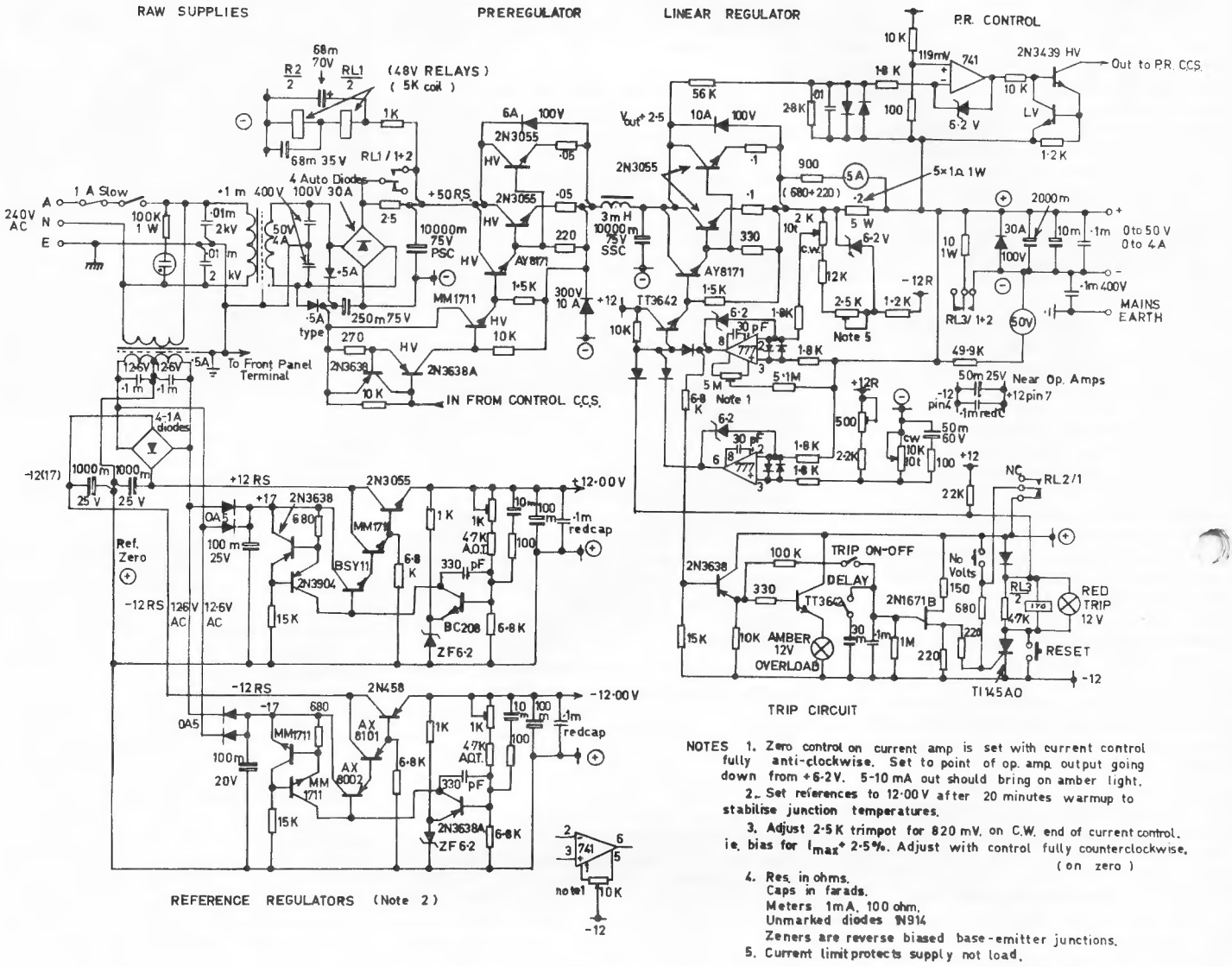


FIGURE 2. CIRCUIT DIAGRAM

onto one input of the respective op. amp. which will drive the output via the emitter follower to make its other input look the same, the other input being connected to the positive solderlug in case of the voltage control amp, and to the other end of a sensing resistor in case of the current control amp. The output of the latter is nominally at +6.2V with respect to the positive solderlug, and the volts amplifier has control. In case of an overload, the current amplifier takes over via the OR gate. This happens when the voltage drop on the sensing resistor exceeds the bias set in on the current control. In order to obtain linear response of this control, the —12V reference is used to make a 6.2V reference with its reference on the regulator side of the sensing resistor R. Both controls employ 10 turn potentiometers with counting dials and that makes it so convenient. You can preset the output to your requirements before switching on and expect to have things happening your way. They do — within 1 per cent. In fact it was found that the control reading is always closer to the output than the meter reading. No regrets are held having spent the extra. It can be done with a coarse and a fine control too, of course, using resistance values of 100 to 1 or 50 to 1, but this costs a bit less and "tastes" rather more ordinary.

Now for the last main blocks, the trip circuit. It is not needed; you can have 0 to 50V and 0 to 4A without that. It's one of those extras like a car stereo or a TV set. Not necessary, but nice to have. Here is how it works. The current control amplifier signals an overload to it and a lamp driver lights up an amber light. If the TRIP ON-OFF switch is made a capacitor will also be charged. This one is in the emitter circuit of a unijunction transistor (UJT) and will switch it on when the capacitor volts are high enough (6 or 7V). The UJT then fires a small SCR which conducts via a resistor and a clamping diode and connects to the 3rd input of the OR gate. It takes over control from the op. amps. and clamps the drive for the regulator emitter follower to just below the volt[illegible] at the positive output terminal, thus switc[illegible]ing the latter off. At the same time a relay slaps 10 ohms across the output and a red light glows. The SCR can be fired manually via the "NO VOLTS" button. To release the clamp we short out the SCR with the aid of the RESET button. To get the delayed TRIP you close the second small switch and the value of C at the UJT is upped to make the charging time longer.

So much then for the tour of the block diagram. Now a few more explanations of various details. Back at the raw supplies, you will find on the detail diagram two more relays. RL1 has two contacts paralleled and is used to short out a "startup" resistor which is used to limit the switch on surge to 30A or so. Both of the relays are delayed a little. RL1 pulls in first and RL2 about 250 ms later. RL2 fires the SCR in the trip circuit as soon as the negative reference comes up, which happens be-

fore RL2 pulls in. This action allows the reference volts and the op. amps to settle. In other words, when switching on "from cold" the supply does not start up under load because the "NO VOLT" condition exists. You have to push the RESET button in order to get an output. It gives the "innards" a second or two to settle. Strictly speaking, that feature is not needed — but it is felt that the start resistor and RL1 are a reasonable idea. There is, also in that block, a 70V peak voltage supply. It feeds the pre-regulator drive via a constant current source with more and cleaner DC than is available on the Primary Storage Capacitor, and drives the pre-regulator emitters closer towards the collectors, saving a bit of heat or dissipation. The link between pre-regulator control and pre-regulator power section consists of two constant current sources, each using a high voltage output transistor.

A transistor switch was wanted on the positive rail. There is the possibility of using a PNP switch in the negative rail which can be fed from a sensing circuit based on OV. However, that would force the whole transformer secondary to fly up and down as it switched, and it was felt that it may generate unnecessary noise. It was fed in — so to speak — bit by bit, you can see it on the circuit diagram. One of the problems was to feed the NPN switch on the positive side with a reasonable value of base current over the 70V range. Resistors just would not do. Constant current sources will. Two are necessary because the control section can be at any level between zero and +50V, and also the pre-regulator switch bases and emitters can be at any level between +2.5 and +52.5V in the off condition. In the on condition they are close to the collector voltage, about 65-75V.

The solution was therefore to give the pre-regulator control section a constant current source. This puts out a 0.5 mA signal whenever the pre-regulator is to be on, and the power section another constant current source, providing a constant 2 mA when requested by the 0.5 mA signal from control, all this regardless of the voltage differences. The type of constant current source will work down to 1.2V as long as enough base current is available for the output transistor. It changes its current with temperature though, because the E to B junction of the bottom transistor is used as the reference. Whereas in this application it does not matter, in others it may. So if you wish to use it elsewhere, you might have to compensate. It's not hard to do.

Some words now on the buffer choke. When the pre-regulator switches off, the choke produces a "backfire" which will drive its pre-regulator end towards OV, taking emitters and bases of the switch with it. Upon going through OV the catching diode turns on and now forces the choke to discharge into the secondary storage capacitor.

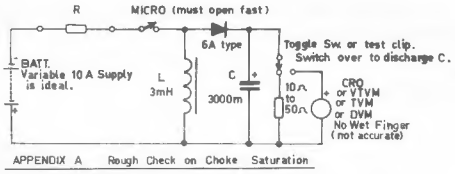
When that job is done the cathode of the diode, emitters and bases of the switch and one collector of constant current source pre-regulator power section, go to the voltage level present on the secondary storage capacitor, until the next cycle.

Heavy diodes have been connected across both regulators and across the output — in reverse. They do not do anything normally but abnormal things can happen. For instance you want more volts and use this supply in series with another. The other one might be switched on first and that would put reverse volts onto the regulators. They do not like it. It cost a few new 2N3055s to find that out, the output goes up and with it the emitters. The collectors are held at OV by an empty large capacitor, and $2.20. Now with the diodes, that last mentioned capacitor is charged and so the reverse volts on the transistors will not be high enough to ruin them. The reverse diode across the output comes into action when polarity mistakes are made. It causes big sparks, blows fuses and saves your circuit. Use one that can stand up to it — like a 30A model, perhaps 50A would be even surer. Ridiculous? Could be, but it's foolproof.

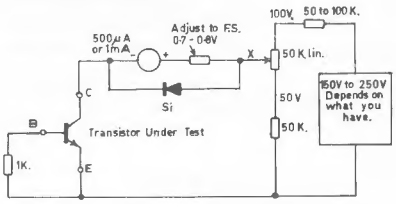
A short note on the reference regulators. The power transistors in the supply are bigger than need be. But what you can shift in a wheelbarrow will not hurt a truck! During experimenting it was found that the temperature stability of the 12V rails was 3 times better, percentage wise, than the 6.2V zeners. It is due to cancellation, in part, of the positive temperature co-efficient of the zeners by the negative one of the E to B junction of the amplifier transistor. One more thought; you can put the rectifier, and capacitor feeding each regulator, on the same etched circuit card, but if you do, beware of hum injection via common ground conductors. It was amazing to see how much voltage will drop along a short strip 2" by ¼". You may possibly want to know why two power transistors were used in parallel in the linear regulator. The beta of 2N3055s and such like drops off fairly drastically at high current levels. Although 4 amps is not all that high it would, in the particular brand used, drive the transistor too close to a region of its characteristic in which the thing starts to look like a transistor with a fairly low value resistor in parallel. That means more noise on the output rail and reduced loop gain. With two helping each other, we have more savoury conditions.

Perhaps even another little trick? Primary and secondary storage capacitors are 10 milli-farad, a fairly large size which keeps the ripple current per unit capacitance down, hopefully resulting in longer life. At the same time there is less ripple voltage for the regulators to iron out. On the output, 3 capacitors in parallel are used in an effort to have the smaller ones shunt the inductance of the larger ones. The meters are hand calibrated 1 mA 100 ohm models.

Little trouble was experienced in getting anything in the unit to work. It really is handy on the bench. When you analyse the circuit you will see that it is all more or less basic ingredients.



APPENDIX A Rough Check on Choke Saturation



APPENDIX B Circuit for High Voltage Test on Transistors

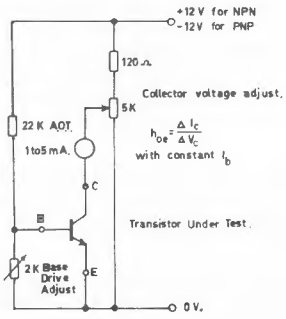


FIGURE 1

APPENDIX C.

APPENDIX A

Rough check on saturation:—

Procedure: Adjust R so that the current through the choke L under test is say to the rated current. Open micro-switch and note reading of VTVM, discharge C. Increase current through L to 2/10ths of rated current. Open micro-switch. The VTVM should show twice the voltage previously measured. Note this value also. Repeat the procedure until an even current increment no longer gives an even voltage increment. The choke is now starting to saturate.

The value of C given will produce a reading of 1V per A. Discharge C each time. The micro-switch needs to make only for ¼ of a second. Test to 10 amps. **NOTE POLARITIES!**

APPENDIX B

Circuit for high voltage test on transistors:—

Procedure: Increase volts slowly until you see meter deflect. From there on, the reading will increase more rapidly. You can use the transistor up to the point of current noise. From there on it may be risky. If a variable supply is available that can cover 50 to 100 volts, do **NOT** use the potentiometer drain. Instead put 50 to 100K into point X. All transistors contained in or connected to the pre-regulator should go to 80V or better. Make certain they do!

APPENDIX C

Checking output admittance, hoe:—

Constant current sources and voltage amps are best equipped with transistors exhibiting low hoe. The circuit described here helps to find them.

Wire up the circuit as shown in Fig 1.

Adjust base drive to give IC used in your circuit with 6 volts (Vc not critical), then sweep collector volts up and down. Look for the transistor with least variation of IC between 1.5 and max. Vc.

In a constant current source, only the output transistor is important in the above respect. ■

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modifying the trio jr60 receiver

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"Woodlands", Wombat, N.S.W., 2595

This article describes a number of worthwhile modifications to the JR60. These modifications are equally applicable to the Lafayette HE80 receiver.

One of these units was acquired some years ago and it was most disappointing to observe that this particular unit drifted bady even on BC. Many fruitless hours were spent trying to improve it. The conclusion was that it was a heat problem due to compact design. First modification involved replacing the 6CA4 rectifier with silicon diodes. Running the valve heaters continuously helped greatly, but valve life was reduced to an unacceptable degree and there was still some drift. The only answer seemed to be transistorisation to eliminate the heat.

This has been a long process over a period of several years and the unit still uses valves for the second IF amp, product detector and 2 metre converter.

The modifications carried out are listed as follows:

(1) A pair of germanium diodes were connected across the antenna input to protect the RF transistor.

(2) The RF valve was replaced with an MPF102 source follower feeding a BF115 amplifier (see AR June 1968) with the emitter resistor unbypassed. A partial bypass (100 ohms in series with 40,000 pF) increases gain but creates cross modulation problems. The existing 1K and 10,000 pF B+ decoupling network was used. The existing AGC decoupling was retained.

(3) The 6CA4 heater winding was connected in series with one of the other 6.3V windings to produce 12.6V AC. This end was connected to a 2500 uF 25V capacitor via a silicon diode. Half-wave rectification seems adequate. The DC output was fed to a 1.5W 12V zener diode via a 300 ohm resistor. This 12V source was fed via a 560 ohm resistor to a 400 mW 6V zener which feeds the local oscillator and BFO. The existing HT wiring was removed from the "remote" socket and 12V connected to this so that the set can be remotely controlled.

(4) The tape recorder outlet was removed and a 3 amp toggle switch fitted in the hole. The converter heater lead was wired in so the heater can be switched off when not in use. This also requires rewiring one dial light so it isn't switched off when the converter is off.

(5) The 6BE6 mixer was replaced with an MPF105, with a 10K source resistor bypassed with 1000 pF capacitor.

The RF transistor was wired to the existing valve socket plus a terminal strip mounted adjacent to the valve socket. The mixer was also wired to the 6BE6 socket. Do NOT wire transistors to 7 pin plugs and plug them into valve sockets if instability is to be avoided.

The original circuit shows a cathode follower between the oscillator and mixer but this was not wired in my set; injection was direct from the oscillator grid to the mixer grid via a 20 pF capacitor.

(6) The 6AQ8 oscillator was replaced with an MPF104 soldered to the valve socket and a terminal strip mounted under one of the socket bolts. No variation was found in calibration with the MPF104 but a slight shift was noticed using a 2N3819. A source follower after the oscillator was tried but it was considered unnecessary. Injection to the mixer is fairly critical. A 5 pF coupling is a good compromise.

The drain end of the RFC must NOT be bypassed since oscillation on top band depends on extra feedback provided by a 10,000 pF capacitor connected to a winding on the top band oscillator coil.

(7) The first IF amplifier was replaced with a MPF105 source follower feeding a BF115 amplifier. To preserve stability the FET should be mounted on the IF transformer and the Bipolar mounted on the 6BA6 IF amplifier socket. Lead length between the FET and the BF115 is not so important, being relatively low impedance. AGC was applied to the gate of the FET via existing components.

From here trouble occurred. Another MPF105, BF115 combination was tried in the second IF but could NOT be stabilised. Replacing the BF115 with a 2N3564 (lower Beta) did stabilise the stage but it then suffered overload. An MPF121 was tried in place of the FET-bipolar combination but had the same overload problem. Not satisfied with the solid state result in this stage, the 6BA6 was re-used.

(8) AGC action was now superior to the original and it was necessary to shunt the S meter with 220 ohms. As each stage was removed from the B+ line the voltage rose as resistive filtering is used. The voltage applied to the second IF 6BA6 screen exceeded valve ratings, so a 22 K ohm 2W resistor was required to feed the screen of this tube.

(9) Several different RF gain control arrangements were tried, but none found satisfactory. Finally the system shown on the circuit was tried. 6.3V AC from the valve heater line was rectified with a silicon diode to produce a negative voltage (no filter capacitor is required) and applied via a 7.5K ohm resistor to the existing 10K RF gain control. The moving arm was connected via a small silicon signal diode (has to be silicon for high back resistance) and a 1M ohm isolating resistor to the AGC line. This gives limited control but is quite smooth and adequate. It does upset the S meter reading but in practice the RF gain is rarely used since the AGC is adequate.

(10) The 6AL5 NL was replaced with 2 germanium diodes mounted on a 7 pin plug with a back cover to protect the diodes, and plugged into the valve socket. The noise limiter is inferior to the original. A silicon diode was tried but was still not as good as the original, however the noise limiter at best is not very effective so the germanium diodes were left in. The germanium diode detector performs as well as the valve.

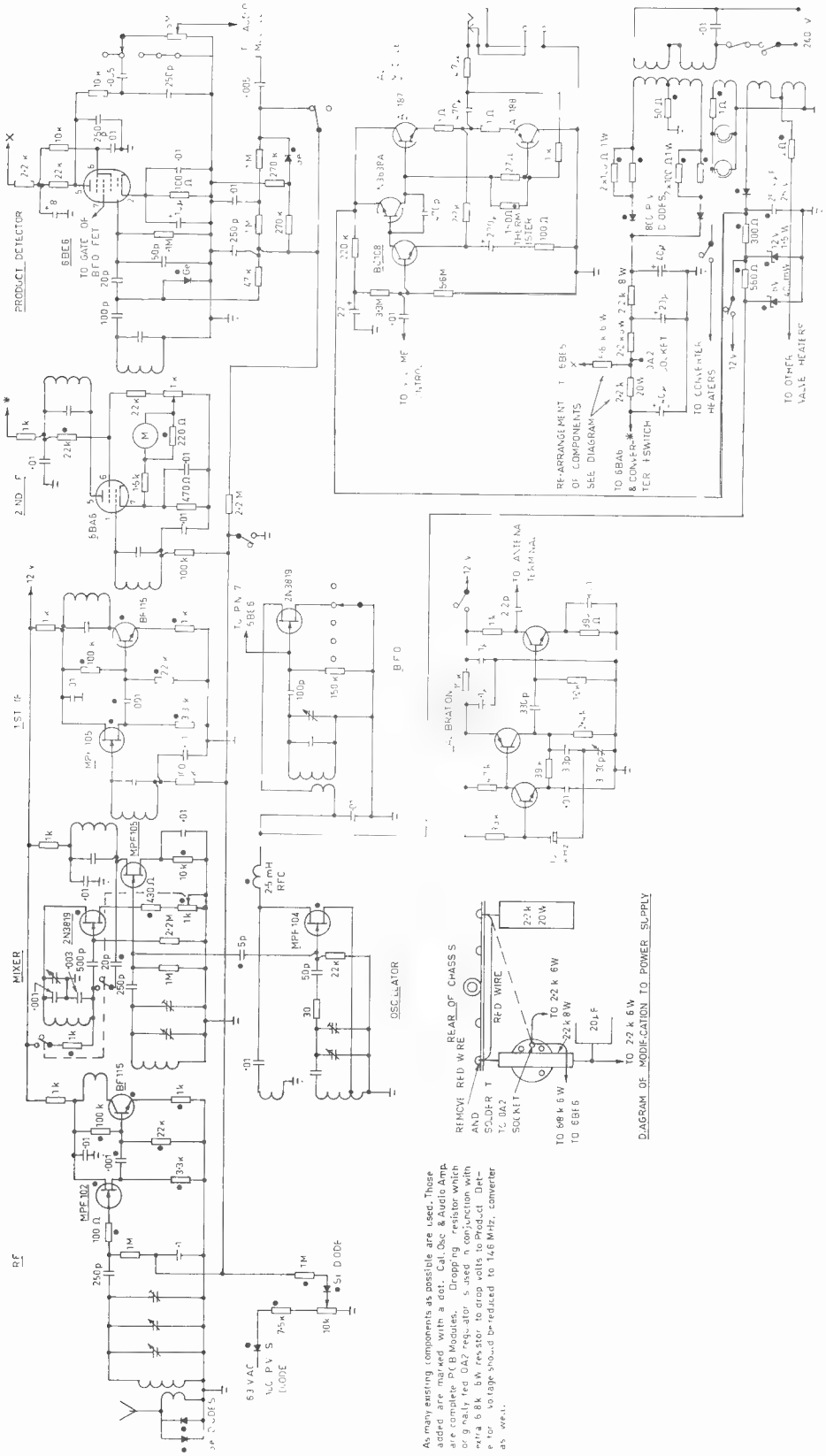
(11) An MPF121 and a 2N3819 were tried as a product detector. The MPF121 worked well on weak signals, but overloaded on strong signals. The JFET worked, but injection was extremely critical (gate injection). Both were inferior to the 6BE6 so the valve was re-installed.

(12) The BFO valve was replaced with a 2N3810 supplied from the 6V DC regulated voltage. The slug in the BFO coil required slight adjustment to centralise the front panel BFO control.

(13) The audio stages were replaced with a transistor amplifier as used in the "EA 270" and solid state Deltahet. The PCB heat sink was home designed so that the unit was self-contained. This amplifier has approximately the same gain as the valve amplifier and produces about the same output with 17V B+ and a 4.7 ohm resistor in series with a 3 ohm speaker.

The speaker should be 8 ohms but all speakers on hand were 3 ohms, hence the 4.7 ohm series resistor. The high input impedance of this amplifier allows retention of the 500K ohm volume control. This module is mounted above the chassis over the sockets of the valve audio amplifier.

(14) The 6AQ8 calibration oscillator and Q multiplier was removed from its socket and a nine pin plug inserted. A 2N3819 was wired to provide the Q multiplier "triode" connections. A 1K ohm switch potentiometer with DPDT switch was fitted in place of the existing 10K ohm potentiometer. This requires enlarging the chassis hole to ⅜", taking care to avoid marking the front panel. Also the shaft of the potentiometer has to be reduced to fit the metric size knobs. This was done using an ordinary file, and some care. (Tip: make a diagram of connections before removing pot). The feed resistor was reduced from 22K to 1K ohm and connected to 12V DC. The original 5,000 pF injection capacitor was reduced to 20 pF since the original design severely detuned



the first IFT. Even with 20 pF some detuning occurs and the capacitor could possibly be reduced, however this has not yet been tried.

(15) Simple replacement of the triode calibration oscillator with a FET did not work. The "EA" circuit (EA Oct. 1970) was built on a home made PCB as shown in the circuit. This circuit works very well and is slightly superior to the original on higher frequencies. This module is mounted above the chassis over the mixer and local oscillator valve sockets.

(16) It is necessary to reduce the HT on the product detector by using an extra 12K ohms of appropriate wattage in the HT feed to reduce the anode voltage to about 100V.

(17) The reduction of current required for valve heaters plus the fact that the TRIO was designed to operate on 220V AC instead of 240V meant that in this set, the heater voltage rose to 7.40V. This was reduced by fitting a 2 ohm resistor in the heater circuit to the 6BA6 and 6BE6 and a 1 ohm resistor in circuit to other lamps and converter heaters. Resistors were made up from resistance wire. Some electric jug elements are solderable but several strands may be necessary to keep the temperature of the resistor down. (Alternatively suitable resistors may be purchased from a radio parts supplier — Ed.). The existing HT resistors can be re-arranged to reduce the HT to appropriate voltages with the reduced drain. The red wire linking the ends of the 2.2K 8W and the 2.2K 20W nearest the rear of the chassis is removed from the 2.2K 8W and soldered to the B+ pin on the now vacant OA2 voltage regulator socket. From this point an added 6.8K 6W goes to the product detector.

This arrangement requires a minimum of change and gives 170V at the B+ end of the 6BA6 IFT plate winding and 75V at screen of 6BA6 (with 33K extra dropping resistor reduced to 22K) with the converter off. With the converter on, the voltages become 115V at the B+ end of the IFT and 48V at the screen of the 6BA6 and 125V to the converter. The 2.2K 6W resistor gets fairly hot with the converter on so if prolonged use of the converter is envisaged, a higher wattage resistor in this position may be desirable.

Although some drift is still apparent, the improvement was well worth the effort. The mixture of FETs used shown on the circuit was not deliberate — they just happened to be ones that were on hand, and although they have not been tried, probably MPF102, 104, 105 or 2N3819 would be equally suitable.

Existing valve circuitry has been retained except where the HT had to be changed to 12V or 6V and, where possible, existing HT decoupling and AGC decoupling has been used. The results have been very satisfying. ■

REFERENCES: Q mult "EA" April 1969 p.58; XTAL CALIB "EA" Oct. 1970 p.101; SOLID STATE MODULES "AR" June 1968; SOLID STATE DELTA-HET "EA" Feb., Mar., Apr., May 1971; EA 270 "EA" Feb., Mar., Apr. 1970.

a cradle for ken

Mike O'Burtill, VK3WW
3 Maxwell St., Lalor, 3075

This is not a bedtime story. Most two metre enthusiasts are familiar with the KEN KP202 transceiver. Those with extensive funds have one as a spare; others, like the author, use a KEN for all 2 Mx FM operation.

It was decided that the KEN could be used for other than portable operation. Mobile seemed a good idea, but how to operate safely in the car?

Being very conscious of road safety and the dangers of driving, it was determined that mobile operation would not compromise the driving technique. Also being very keen on caravanning, the car is a manual shift model. (It is believed that a manual is a better all-round towing vehicle.)

The following requirements for mobile operation with the KEN were set:—

1. Switch to talk (not PTT).
2. Boom microphone (two hands on the wheel).
3. Power from car circuit rather than in-built batteries.
4. Minimum action to revert to hand-held portable operation.
5. No serious change to appearance of the unit.

For every change there is some compromise. In this case it was decided that the nicad battery positions were not required, so this space was used for the power circuit modifications. Of course, if you want to use nicads you don't really need to use power from the car, so just delete this section of the modifications.

A 2.5 mm socket was fitted to the base of the KEN battery box. Be careful of the metal plate in the base, also the two nicad charging points are not slotted so initial removal is difficult. Before reassembly, cut a slot in each screw thus allowing a screwdriver to be used for reassembly.

Trace the power circuit with a multimeter and wire the socket so that with the plug removed internal batteries run the rig, and with plug inserted external power is applied. This system has the added attraction of being available for use with a bench power supply.

The socket can hardly be noticed in the base so does not detract from the appearance of the KEN.

Speaking of appearance, the only visible modification is that which brings the speaker and microphone connections from the unit to two 3.5 mm sockets.

Drill two ¼ in. holes in the name plate just below the speaker. Through these holes bring twin shielded cables, one for speaker and one for microphone. These are wired to the 3.5 mm sockets so that the internal equipment operates when no plug is inserted, and external equipment is connected when the plugs are inserted. (Plug insertion disconnects internal equipment.) There was no room to mount two 3.5 mm sockets on the case of the KEN, so a mounting plate was made from a piece of copper. The plate measured 6.5 mm x 6.2 mm and was bent as shown in the diagram. With careful application of paint this can look quite neat and, while it is an obvious modification, it does not detract from the KEN's appearance too badly. Four small holes are drilled at the corners and the plate is mounted using small self-tapping screws.

Once installed any type of external microphone can be tried. If you don't have a boom microphone, try one of the cheap JA microphones that can be hung around the neck; some work quite well.

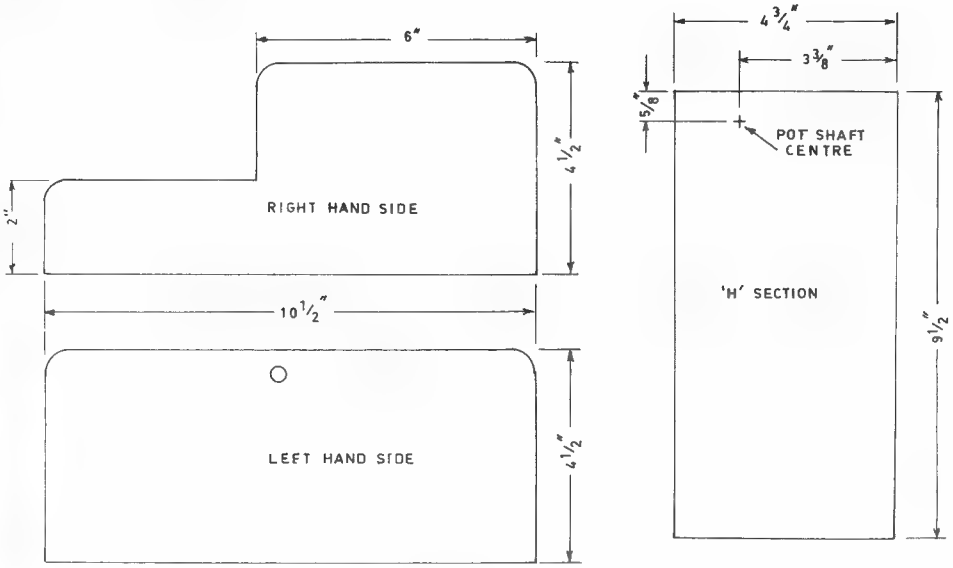
The external speaker function is not used in this installation, but is there to balance the appearance and to provide the facility to use an ear piece if required.

We now have inputs for power, microphone and speaker, all of which disconnect the in-built equipment.

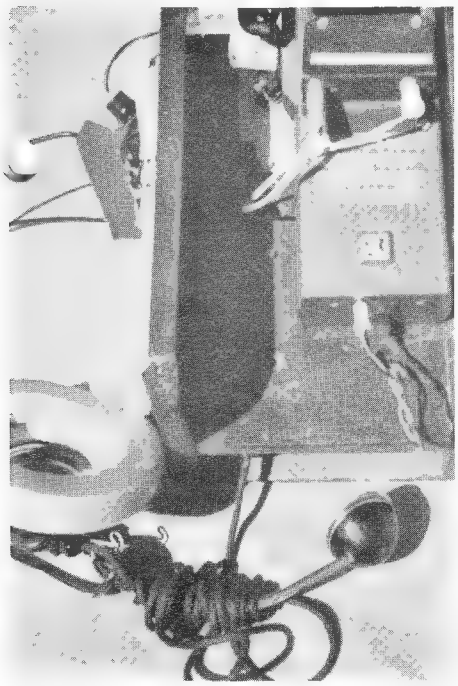
All that is required now is switch-to-talk and the rig will be ready for mobile operation.

One look at the miniaturisation in the KEN and all thought of bringing the PTT function out to a plug or some such is forgotten.

If it cannot be done electrically, then try a simple mechanical device. It was reasoned that if the KEN were to be held firmly in one position, a cam could operate the PTT. Here was borne the idea of the cradle.



'KEN' CRADLE ALL MATERIAL ½" BOARD



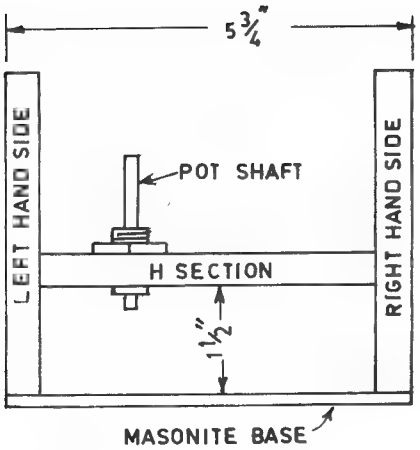
A close-up of the complete installation ready to put in the car.

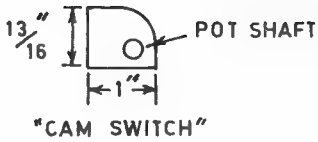
A U-shaped cradle was knocked together from scraps of pine board, and a small cam was made of the same material. An old "pot" shaft was fitted to the base of the U in such a position that it could swing the cam against the PTT switch on the KEN. Once this was tested the cam was glued (araldite) to the pot shaft and the lot was fitted to the cradle.

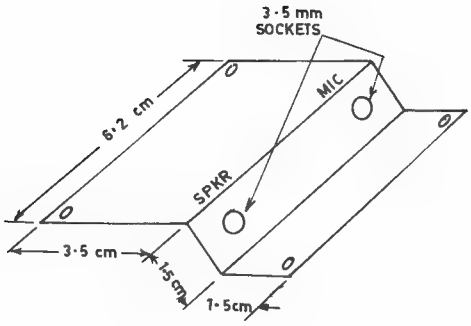
This first cradle was rough and ready, for in addition to holding the KEN position, it also contained the socket for the head set and a filter board which was made up for mobile operation.

This set-up was used with good effect until June '74, when the time was found to design a better cradle and neaten the whole thing up.

Pine board (½ in.) was used and this







time a form of "H" structure was made (see photos and diagrams). The base of this was covered with masonite which was found to slip on my seat covers. To stop this two strips of "hook" were glued to the base which stopped all slipping.

(Hook strip is one part of the stuff used for joining materials by pressing them together. The complete system is called "hook and pile".)

The construction of the cradle is a simple woodworking job; ¼ in. dowel, 1 in. panel nails, Selleys Aquadhere, and ½ in. pine board.

For anyone who wishes to copy this design, diagrams giving dimension are provided. Obviously this idea could be adapted to suit many different cars and radio equipment.

The cradle holding the KEN sits on the seat on the left and when desiring to transmit, just throw the cam switch with your left hand. When finished, release the cam and you are receiving.

Apart from the very quick excursions of the left hand to set the cam switch, you have two hands on the wheel all the time. The diagrams and photos show the cradle and cam switch. A small clip on the left hand side of the cradle holds a mini log in which to log mobile QSOs.

It is hoped that this short article will be of interest to other KEN owners and perhaps stimulate a few more ideas. See you on two mobile. ■

rotating a 3 element 20 metre beam with a stolle

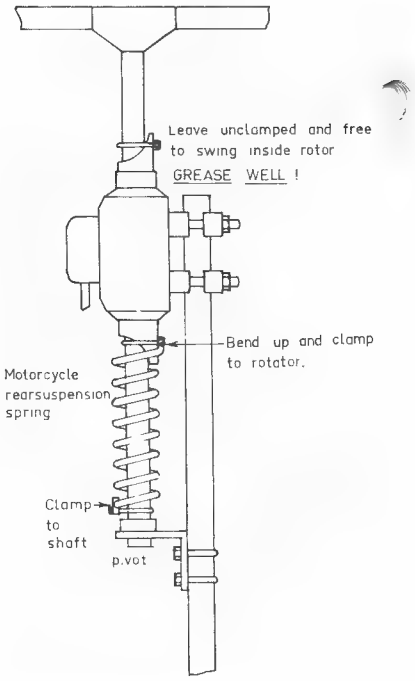
L. R. Newsome, VK4LR
58 Prospect Terrace, St. Lucia, 4067

Not wanting to go to the expense of a heavy-duty rotator, the way was cast to enable a TV type rotator to be used with a shortened version of a 20 metre yagi. The trick is easy enough.

While TV type rotators are capable of carrying up to about 20 kg in load, they are limited in the amount of torque which the motor gearing can supply to the rotating elements. It is not that a large array requires a large turning torque, once the array is on its way. It is the initiating impulse to start the array, and the mechanical strength necessary in the gearing to stop the array at the required place. More seriously, a gust of wind hitting the array off-centre can severely damage the lightweight gearing in the rotator.

The solution was to take all bearing weight off the rotator and provide a mechanical buffer between the beam's mass and the rotator. The mechanism is depicted in the drawing. The buffer was a spring from the rear-end of a motorcycle. With the aid of an "oxy" torch, the ends of the spring were turned at right-angles to provide lugs for clamping to both the shaft of the beam and the rotator. The head weight of the present beam is about 8 kg and the boom is 6.5m of 5 cm diameter aluminium. The longest element is about 8m, each element being shortened by the use of loading inductances 1m in from the ends.

So far the rotator has been in service for about two years and has passed through one or two mild cyclones. The rotator can be reversed instantly while the beam is still swinging in the opposing direction. The motor seems to accept this abuse quite readily. On initial operation, the beam seems to take about three or four seconds to start moving, although the motor can be heard running almost instantly. Some lag and oscillation occurs at the ends of the run also. In a high wind the beam will oscillate up to about 20 degrees in either direction, but this is a small matter. One does, however, have to check the wind conditions before giving out a report of rapid QSB! ■



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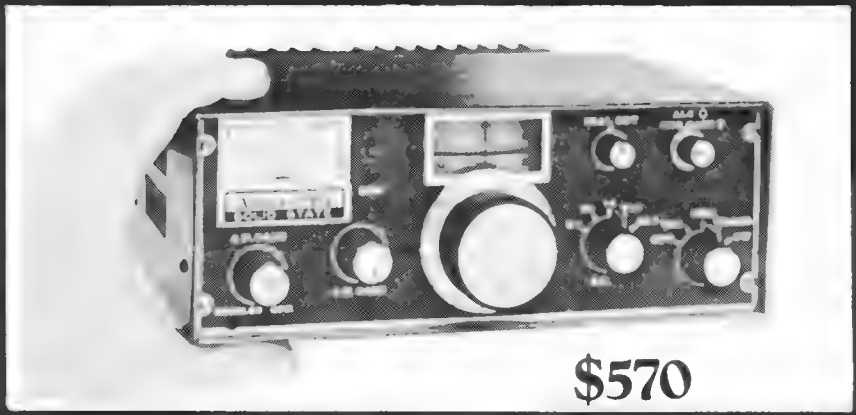
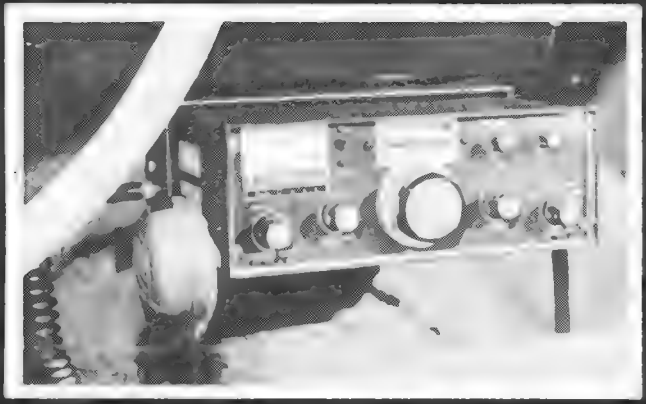


$570

. . . AND THE COMPANION MODEL, ATLAS 215 WHICH COVERS 15, 20, 40, 80 AND 160 METERS.



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Operates directly from
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Only 3½ inches high, 9½ inches wide,
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Built-in speaker.

OR . . . PLUGS INTO AC CONSOLE

With front facing speaker,
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and other accessories.

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The Sensational ATLAS-210/215

GENERAL SPECIFICATIONS

- **Atlas-210, Frequency Coverage With Internal VFO:** 3700-4050, 7000-7350, 14,000-14,350, 21,100-21,450, and 28,400-29,100 KC.
- **Atlas-215, Frequency Coverage With Internal VFO:** 1800-2000, 3700-4050, 7000-7350, 14,000-14,350, and 21,100-21,450 KC.

  NOTE that the 80 and 15 meter bands can be easily owner adjusted to cover any 350 KC portion of the band, and that 10 meters can be adjusted to cover any 700 KC portion.

- **Frequency Readout:** Dial scale calibrated in 5 KC increments on all bands except 10 meters, where increments are 10 KC. Tuning knob skirt provides 1 KC increments on all bands except 10 meters, where increments are 2 KC.
- **Frequency Ranges When Using Model 10X Crystal Oscillator Accessory:** 10 Crystal positions permit fixed channel operation as follows:
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- **Special Mars Models, Atlas-210M and Atlas-215:** These models offer extended frequency range when crystal controlled by the model 10X crystal oscillator accessory, as follows:
  1800-2400 kc (Atlas 215M only), 3300-4600, 7000-8000, 13,900-14,900, 20,600-21,450, 27,500-30,000 kc (Atlas-210M only).

  Notice that the internal VFO ranges in the 210M and 215M are identical to the standard 210 and 215. The extended frequency ranges are provided only by use of the 10X crystal oscillator.

- **Circuit Design:** Single conversion, 5520 kc I.F.
- **Finish:** Vinyl Covered Steel. Durable and scratch resistant. Black.
- **Dimensions:** 9½ in. (24.1 cm) wide, 3½ in. (8.9 cm) high, 9½ in. (24.1 cm) deep, overall.
- **Weight:** 6 lbs. 14 oz. (3Kg) net. 8 lbs. 6 oz. (3.7 Kg) Shipping weight.
- **Frequency Control:** Highly stable VFO, common to both Receive and Transmit modes. Tuning dial calibrated in 5 kc increments with easy interpolation to 1 kc. Tuning rate is 15 kc per revolution.
- **External Frequency Control:** Rear socket provides for plug-in of external VFO or crystal oscillator for separate control of transmit and receive frequencies, or for network and MARS operation.
- **All Solid State:** Includes 4 I.C.'s, 18 transistors, 32 diodes.
- **Modes of Operation:** SSB (selectable USB or LSB), CW with offset frequency in transmit mode.
- **Modular Construction:** Includes plug-in circuit boards for ease of service and maintenance.
- **Plug-in Design:** Rear connectors are designed so the transceiver plugs into the Mobile Mounting Bracket, or into the AR-117 desk top power supply, making the transfer or removal a simple operation. Transceiver may be secured to the Mobile Mount, if desired. All connectors are standard: SO-239 antenna jack, ¼ in. phone jacks for Mic., CW key, External speaker or headphones, and linear amplifier control.
- **Power Supply Requirements:** Operates directly from 12-14 volt D.C. source, negative ground (standard automotive electrical system). Draws 300 to 500 ma. in receive mode, 16 amps peak in transmit mode. (Atlas models AR-117 and AR-230 desk top power supplies are available for AC operation.)
- **Front Controls:** Tuning Dial, Dial Set, Function Switch, Band Switch, A.F. Gain, R.F. Gain, Mic. Gain, Sideband Selector, Calibrator Switch, Dial Light Dimmer.

PRICE LIST

Atlas-210/215 SSB Transceiver	$570
Atlas 210M/215M (Mars Model)	$585
AR-230 Power Supply	$150
AR-200 Portable AC Power Supply	$96
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WRITE FOR DETAILS

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— external VFO $80
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fm directory

We are Australian agents for ICOM quality VHF/UHF transceivers.

2

Vicom have made available a frequency counter in the front window of the Auburn showrooms to assist mobile 2M FM rig owners in staying on frequency. Come anytime and tune your rig while parked at the curb.

off beat ?

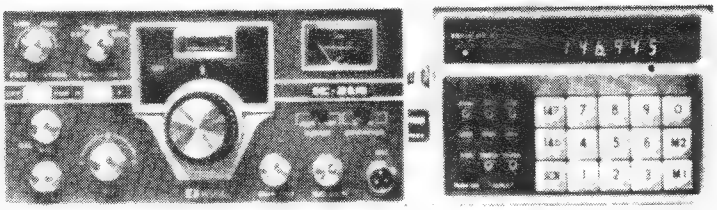
2

TRIO TR2200G hand held 2 metre portable transceiver incl. 2 channels 1/50.

KEN KP-202 hand-held 2M FM 2 watts incl 4 chs (40/50/1/4) $150.

— Nicad chargers and nicads $32

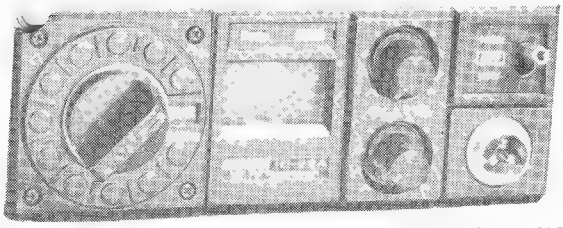
— stubby helical whip $8.90



IC21A - $298 DV-21 - $298
BOTH FOR $570

DV-21 DIGITAL VFO employs a PLL synthesised system with 59 ICs, 34 transistors, 1 FET and 37 diodes. It can be INTERFACED with the IC22 or any 2m transceiver with 44-45 MHz rx 18 MHz tx, 10.7MHz i.f., lwr side hetrodyne, 8 x basic freq. for tx and 3 or 9 x basic freq. for rx. Only a slight modification is required for such equipment and is detailed in the operating manual. It operates in 5 or 10 KHz steps from 146 to 148 MHz and can scan either empty frequencies, or the frequencies being used, whichever you select. Complete separate selection of the transmit and receive frequencies is as simple as touching the keys. When you transmit, bright easy to read LEDs display your frequency. Release the mic switch and the receive frequency is displayed. These are two programmable memories for your favorite frequencies. You won't believe the features and versatility of the DV-21 until you've tried it. Price $298 includes VICOM 90-day warranty.

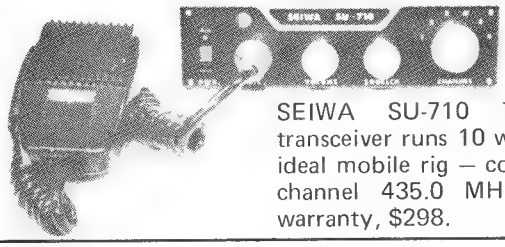
THE IC21A is the 10w base station or mobile (146-148 MHz) with variable power control, adjustable deviation, 24 channels, built-in discriminator meter, S meter, SWR meter, PA protection, modular circuitry, runs from 13v DC or 240v AC. Complete with three channels. Price $298, extra crystals $7.80 pair.



2

AUSTRALIA'S BEST SELLING 2M FM rig — the IC-22A

IC22A 2M FM TRANSCEIVER replaces the IC22 and is identical electronically, but features a redesigned front panel with easier-to-read channel selection. It features switchable power 1 or 10 watts, 22 channels, solid state T/R relay, built-in PA protection, filtered d.c. voltages. The unit comes complete with mounting brackets, microphone, cables, etc, and three channels — 1/4/50. Price is $210 incl. tax and VICOM 90-day warranty. Extra cystals $7.80 pair.

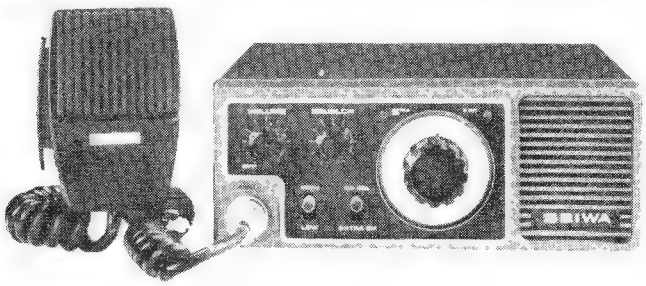


70cm

SEIWA SU-710 70 CM FM transceiver runs 10 watts and is the ideal mobile rig — complete with 1 channel 435.0 MHz and 90-day warranty, $298.

SEIWA SV-230 2M FM, mobile incl 3 channels, 25 watts! $210

2



Open Friday nites and Saturdays.

ICOM IC-60 FM 10 watt mobile transceiver, complete including two channels, mic, cables and mobile mount. Price $235.

6

ICOM IC-30 FM 10 watt mobile 70 CM transceiver for 70 CM, includes 1 channel 435.0 MHz, mic, cables and mobile mount, $370.

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RAC ANTENNA					BY VICOM
	Model	Imp	Freq	VSWR	PRICE $
BALUNS	BL-50A	52	1.8 - 38MHz	1.3:1	14.90
	BL-70A	75	1.8 - 38MHz	1.3:1	14.90
COAX SWITCHES (2 & 6 pos)	CS-2A	52	to 300MHz	1.3:1	21.00
	CX-6A(A)	52	to 500MHz	1.3:1	54.00
	CX-6A(B)	75	to 500 MHz	1.3:1	54.00
TRAP DIPOLES	III-N	52	7 to 28MHz	1.2:1	31.00
	AL48DXN	53	3.5 & 7MHz	1.2:1	31.00
	AL24DXN	52	7 & 14MHz	1.2:1	24.00
	A-4VPN	52	3.5MHz	1.2:1	24.00
	A-8VPN	52	7MHz	1.2:1	26.50
LISTENER	L1	75	3 to 30MHz	–	14.90
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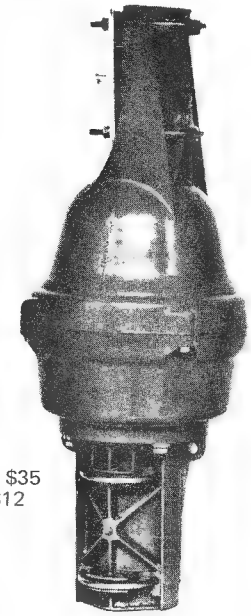
M21 2m steel ¼w $6.90
LINDENOW 2m 5/8 whip $21, base $2.60
RINGO ARX-2 6db 2m gamma matched vertical $35
Extension kit to improve gain of the old AR-2, $12



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TRIO SG402 RF GENERATOR covers 100KHz to 30MHz $76
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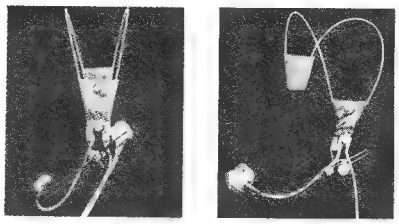

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microstrip data curves

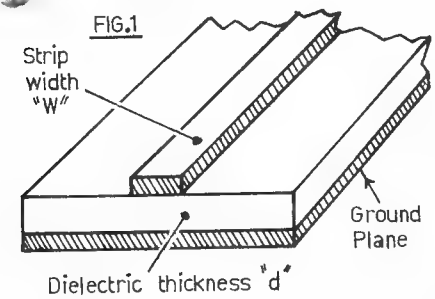
Neil Weste, VK5TB
Electrical Engineering Dept.,
University of Adelaide, S.A. 5000

Interest is growing in the ultra high frequencies, on which certain techniques are useful, although impractical at lower frequencies. The one dealt with in this brief review is the use of microstrip transmission lines.

The construction of the line consists of a ground plane separated from the conductor by a dielectric (see Fig. 1). An ideal medium to form such a line is double-sided fibreglass circuit board. Despite some limitations it provides a good basis for experiments with microstrip.

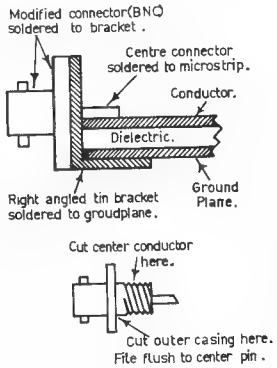
Recently a number of articles have appeared relating to the use of microstrip in amateur projects. Refs 1, 2. It is the main purpose of this article to present the relevant-design curves to enable the amateur to "roll his own" filter, coupler, or other transmission line device.

FIG.1



As with other transmission lines there are two parameters of interest, these being impedance and velocity factor. In the microstrip medium the factors affecting these two quantities are the dielectric constant of the separating dielectric (K), the distance of separation (d) and the width of the strip (w). In amateur circles the most available medium would be fibreglass PCB. With this in mind the parameters for this medium are presented in graph form in Figs. 2 and 3. This assumes d = 0.0625 in, K = 4.4. It has been found in practice that these values represent a good average of the different boards available. Thus for width w, the impedance may be read off the graph. Similarly the velocity factor may be found.

FIG.4. INTERFACING DETAILS.



EXAMPLE 1

Suppose a quarter-wavelength 50 ohm line is needed at 1296 MHz. From the graph it is found that a width of 0.115 inches gives an impedance of 50 ohms.

Next, for w = 0.115 in, it is found that the velocity factor (n) = 1.84. Hence length of line . . .

$$\frac{3 \times 10^8}{1296 \times 1.84 \times 4}$$

Included in Figs. 2 and 3 are the curves for teflon-impregnated fibreglass PCB as used by DJ1EE in his 1296 preamp.

This extra data enables one to convert from one medium to another, allowing the cheaper PCB to be used. Values assumed were d = 0.0625 in and K = 2.1.

INTERFACING AND USES

The lowest discontinuity (and hence loss) results when the coaxial connector is mounted as shown in Fig. 4. Usually connectors have to be modified to fit flush with the structure, this being achieved by a touch of discreet cutting and filing. The protruding centre conductor is soldered to the microstrip.

To use microstrip fully, an understanding of transmission line techniques is definitely an advantage. However, with a bit of imagination, uses will become evident. The primary aim of this article is to present the data, and it is hoped that future articles will show the methods of design and indicate where the line can be used.

LIMITATIONS

Microstrip is a relatively low Q transmission line and thus more lossy than stripline or waveguide. However the losses involved are still very small. An improvement may be made by using teflon-glass board but considering the economics it is the author's view that fibreglass PCB provides the best compromise. At 2.5 GHz the losses are still at a tolerable level for most amateur applications.

Accuracy of strip widths and lengths is another minor problem. The claimed accuracy of the graphs is plus or minus 2 per cent. Considering the flatness of the graphs around 50 ohms, one may be confident that the design is reasonably close. Keeping to an accuracy of 0.05 in will usually suffice.

CONCLUSIONS

While only an outline has been presented, it is hoped that the data presented will provide some motivation to explore new methods and techniques in our UHF bands.

REFERENCES

1. "23 cm Preamplifier with printed microstrip-lines", K. Hupfer, DJ1EE. VHF Communications, Sept. 1972.
2. "A High-Performance Balanced Mixer for 1296 MHz", Paul Wade, WA2ZZF. QST, Sept. 1973.

FIG.2
MICROSTRIP CHARACTERISTIC IMPEDANCE

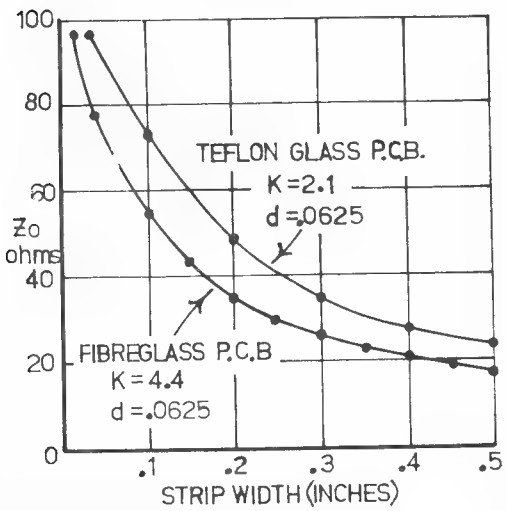
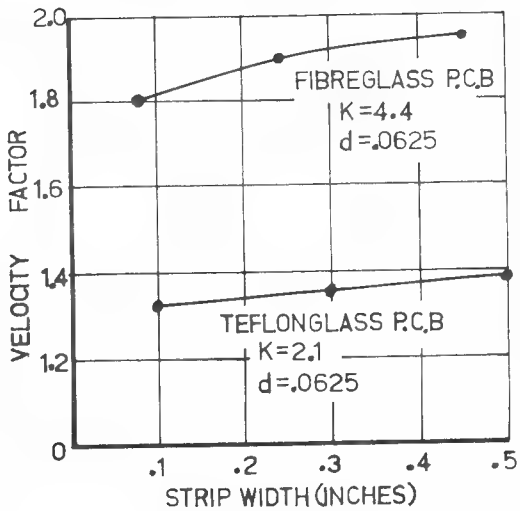


FIG.3
MICROSTRIP VELOCITY FACTOR



proportional crystal oven

H. MOORES, VK4IJ
6 Thomas St., Wilston, Brisbane, 4051

The following is used to hold the temperature of the crystal of a frequency counter at 40 deg. C. A special crystal was ordered for this temperature.

Five silicon diodes in series, type unknown, ex computers, are used as the sensing element. These are in series with a 16k resistor across a 7V Zener rail connected to one input of a uA741 op amp: the other input is connected to the same 7V rail through a trimpot, which sets the desired temperature.

The sensitivity is such that holding the sensing diodes between the fingers will swing the output of the op amp from 9V to zero.

When the unit was finally set up, the trimpot was replaced with fixed resistors, juggling the values to obtain the desired temperature.

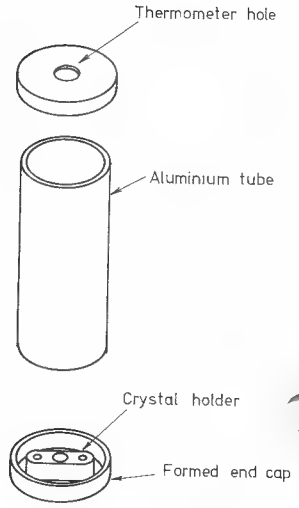
The oven consists of 2" of 7/8" ID aluminium tubing, squeezed in a vice to an oval. Caps were cut from sheet aluminium, flanges formed on them and the lower one araldited on. An HC6U crystal holder mounts by a bolt through the lower cap. Two strands of fine wire through insulating bushes connect to the crystal. These are fine so as to prevent thermal losses through the leads. The heating element is 15" of fine (probably 40 SWG — Tech Ed.) Nicrome wire wound over aluminium tube with a couple of layers of brown paper under it for insulation. The sensing diodes were tightly tied over the element with cotton and the whole liberally covered with araldite. Very close contact between the sensing diodes and the element is necessary to prevent hunting.

The use of brown paper and araldite in an oven may seem out of place, but remember the temperature is only 40 deg. C.

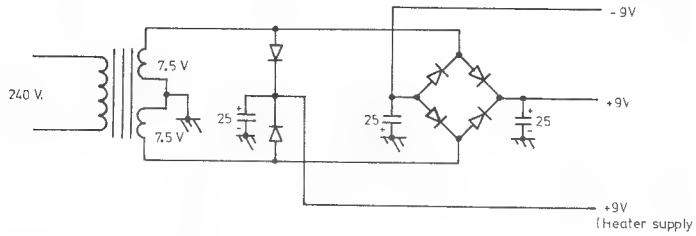
The oven is clamped between two hollowed out pieces of Coolite to provide thermal insulation. A ¼" diameter hole (normally plugged) permits the use of a thermometer for setting up.

The power supply is provided by one 15V CT, 1 amp rated, transformer. The op amp draws about 20mA, and the heater 450mA cold; this reduces to 100mA after a few minutes and finally settles down to about 50mA.

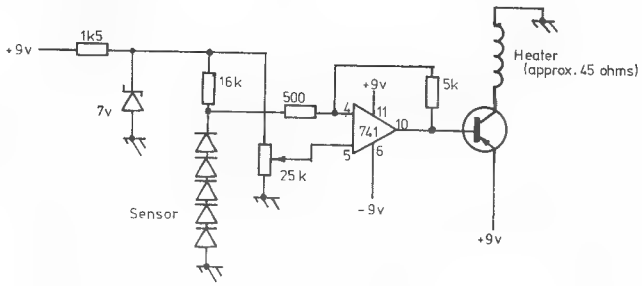
The value of the electrolytic capacitors may seem low, but they were on hand and they work OK.



CRYSTAL OVEN CONSTRUCTION



POWER SUPPLY FOR VK4IJ CRYSTAL OVEN



VK4IJ CRYSTAL OVEN

Try This

with Ron Cook VK3AFW
and Bill Rice VK3ABP

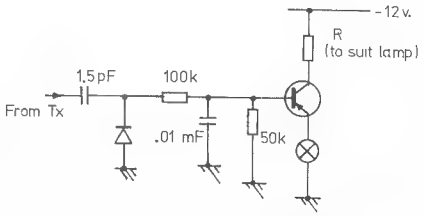
MOBILE OUTPUT INDICATOR

This output indicator is fitted to a "Courier Car Phone" and removes the query "Am I getting out?" when no one replies to your calls. The coupling capacitor is only 1.5 pF and so there is no discernable loss of output, measured on a Field strength meter with the indicator connected.

The indicator bulb is a panel light from a VW which mounts through a ¼" hole in the front panel, and is held in place by two rings cut from thick walled plastic tubing of ¼" ID.

Some juggling with resistor values will be necessary to give a satisfactory indication, the ideal is the bulb just coming to maximum brightness with full TX output.

H. Moores, VK4IJ



MOBILE OUTPUT INDICATOR

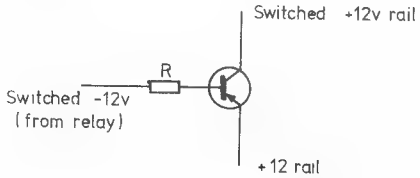
EXTRA RELAY CONTACTS

After fitting the front end of a VK3 (Jenkins/Hepburn) carphone to my courier car phone, I was faced with the problem of supplying a switched plus 12V rail to the front end as the courier uses P types and the new front end N type devices.

No extra relay contacts were available, but a switched minus 12V rail was. The use of one PNP transistor solved the problem thus:

(The resistor "R" in the diagram is for base current limiting, around 6.8k ohms — Ed.)

H. Moores VK4IJ



EXTRA RELAY CONTACTS

Newcomers Notebook

with Rodney Champness VK3UG

44 Rathmullen Rd., Boronia, Vic., 3155

A NEW CONTRIBUTOR

My pleas for assistance in producing Newcomers Notebook have brought a welcome offer of help from David Down of Christies Beach in South Australia. With David's assistance it is hoped that a wider range of subjects of interest can be covered — and a vital point is that you will get two points of view instead of one. David's first article will be on setting up a station for low power DX. For the Newcomer to amateur radio it will set you on the road to DXCC.

Presently more short circuits and other articles from Zero Beat will be published. For a few months it has not been possible to produce articles. During that period a transceiver was designed and is nearing completion. A few problems have been encountered with some established American and Australian designs — to put it plainly they don't work properly. More of this later — now over to David.

LOW POWER DX

Many new amateurs gain the impression that expensive equipment, a hilltop QTH, and a lot of luck are the requisites to make regular foreign contacts. This is categorically untrue. For the newcomer, be assured, many long distance contacts are made every day with simple equipment, from urban residential locations. How then does one start?

FIRST:

We'll assume you are a licensed amateur, or soon will become one, and that you are in a position to establish a simple station. If you are the holder of one of the new advice licences (when they arrive) strive for the full licence as soon as possible.

SECOND:

Plan your equipment to operate on *one* of the DX bands, 7, 14 or 21 MHz. Going multiband can come later, and will be the subject of a future article in this column. While it is natural to want to become *multiband* like most others, it is a natural progression from the suggested *monoband* operation, by which time, certain listening and operating expertise will have been attained, a knowledge of propagation will be added to by simple practical application, certain aspects of antenna design, construction, erection and tuning will be more familiar and the operator will have a greater depth of constructional knowledge of equipment he will need, on which to expand.

THIRD:

Plan to do most of your serious long distance, low power work on CW (morse). Less generated power is required for DX work, equipment construction is simpler and more economical, and in addition, prototypes have been, and are still being built by the author, for insertion in this column as projects towards setting up your first low-power, home-brew DX station.

FOURTH:

Plan to spend plenty of time and work on your antenna system, as this is primarily where the important factors in DX work commence. A monoband rotary beam, vertical whip or half-wave dipole antenna can be employed, and the RSGB and ARRL handbooks can provide many types to choose from. It is up to you to select, construct and erect the antenna of your choice, but *don't* let it stop there. Experiment with antennas, their theory, construction, location and methods of *feeding,* and you should learn a lot, in addition to achieving self-satisfaction from something so important that you have done *yourself.*

FIFTH:

Provide yourself with a good receiver, the basic requirements of which include:

1. Freedom from bad connections and hand capacity.
2. Stability — the ability to tune in and hold a signal despite reasonable mechanical shock and over a reasonable period of time.
3. Sensitivity — the ability to bring weak signals up to an audible level. A good practical test is to alternately connect and disconnect the antenna at the receiver. If the noise level does not markedly increase when the antenna is connected, your receiver will hardly do well on weak foreign signals.
4. Quietness and convenience — your receiver should not produce any sounds apart from a smooth quiet hiss when the antenna is connected (until a signal is tuned in). If it hums, crackles, grunts or groans, it needs internal attention (or maybe even replacement). It should also have a non-slip, smooth-acting tuning mechanism if you are to tune in the weak ones on the nose. A receiver need not be expensive and indeed, a properly built 2 valve unit will qualify easily on all four counts. *Remember,* it is not how loud the signals are, but how well the *weak* ones come through, that counts.

   For best results, use your transmitting antenna for receiving too.

SIXTH:

Use a good variable frequency oscillator (VFO) with your transmitter. Construction details of a suitable and economical VFO will be another project in the series forthcoming.

SEVENTH:

Adjust your transmitter to produce a steady, clean, reliable signal. If one or more valves overheat, bad connections exist, or it needs a kick to make it work, you'll miss many good DX chances (in addition to incurring the PMG's displeasure.) The transmitted power is inconsequential, both experience and maths verifying that, indeed, the *lower* the power, the greater the challenge to the *true* Amateur Operator. Anyone can catch fish with a depth charge, similarly, anyone can contact all the continents in one afternoon with a 400 watt, store-bought transceiver, but that is commercial radio, not amateur radio. 30-100 watts is adequate and sporting.

EIGHTH:

Operate intelligently. *Never* call CQ DX. Instead, wait and listen for the foreigner's call, then answer it. Look for DX at the proper time. You must be on hand when the ionosphere is right, if you want results. Be a gentleman. Other amateurs judge you and your country by your behaviour on the air. Don't give up. Try another time, another antenna or a different frequency, but there are plenty of DX stations about, so start your planning, and go to it. ■

Commercial Kinks

with Ron Fisher VK3OM

3 Fairview Ave., Glen Waverley, 3150

A DRIVE CONTROL FOR THE OLDER SSB TRANSCEIVERS

Most of the original sideband transceivers such as the Swan 240, 350 series, the Galaxy 300 and the National NCX3 did not incorporate any form of drive control as an aid to the tune-up procedure. In all cases a carrier balance control was provided and this was used to provide some carrier for tune-up and also for AM transmission. In many ways this was not an ideal method. Firstly the minimum carrier position was often a very critical point, difficult to find without some sensitive RF indicating device. As later model sets have shown it is better to leave this control set and provide a separate carrier control.

In all cases this proves to be a simple modification. In the case of the Swan 350 it is necessary to connect a one megohm potentiometer in series with the wire connecting pin 9 of the 7360 balanced modulator tube (V13) to the receive/tune switch S2. Now remove the 50 pF capacitor connection on S2 and return this to a convenient ground point.

For the earlier Swan 240 the modification is similar. Once again a one megohm potentiometer is inserted in the lead connecting pin 9 of the 7360 (V9) and the function switch SW1. The 50 pF capacitor from pin one of the 6U8A carrier oscillator to the function switch should be disconnected at the switch end and grounded.

No doubt many owners of early model Swans have looked at photos of the later model 500C and 500CX and noticed a small knob to the left of the dial labelled "output level". This knob does not in fact vary the output level at all, but only output indication on the meter when in the tune mode. It is however an ideal place to put your new carrier level control.

Commercial interest

Looking through a copy of Ham Radio magazine the other day I noticed the following under the signature of James Young from Spectronics, the US Yaesu agents of that time. In relation to spurious output from the FTDX 560 he states; 'Starting with serial number 30001, the VFO frequency range in the FTDX560 was changed from

Some of our Accessories for the Amateur Station

BALUNS

RAK BL-70A, 75 ohm, especially suitable for dipole use ... **$15.90**

KW Balun, 1:1, for 50 or 75 ohms, screw terminals, 1kW **$11.90**

BN-86, broad-band ferrite Balun, 2 kW for Beams and Doublets ... **$24.00**

BN-27A as above especially for 11m CB band ... **$22.00**

ROTATORS

Ham II, 230 V AC ... **$175**

AR-22L Light, low cost rotator, 230 V ... **$59**

Cable & Conductor for Ham II CD-44 ... **75 cents** yd.

ANTENNA ACCESSORIES

LA-1, Lightning Arrestor, for installation in standard 52 or 72 co-axial feedline, designed to Mil. specs. ... **$39.00**

LA-2, smaller size co-ax arrestor ... **$8.75**

C1, Centre Insulator, for Doublets ... **$10.00**

421A, Power meter, 3-60 MHz, reads SWR, power on 10, 100 & 500 W scales, and AM modulation percentage. Especially made for Novice & Marine 11m use ... **$48.00**

476 TVI filter, attenuation begins at 41 MHz and is 25 dB down at 54 MHz, SO-239 connectors ... **$15.00**

Yaesu TVI filter, 3 section, with SO-239 connectors **$25.00**

KW TVI filter, 5 section, SO-239 connectors, A superior job with excellent attenuation ... **$39.50**

KW Multiband trap dipoles:—
With approx. 65 ft. co-ax and balun, 500W **$87.75**
With approx. 65 ft. co-ax and balun, 1000W **$108.00**
With approx. 75 ft. twin feeder ... **$69.75**

Porcelain Egg Insulators ... **17 cents**

WIDE RANGE of Co-axial cable and connectors in stock.

K-20 70 ohm twin feeder ... **24c** yd.

KW multi-band dipole traps with ceramic "T" centre insulator, 80-10m bands per pair complete with insulator ... **$24.00**

KW co-axial switch, 3 position, 500 MHz ... **$19.50**

Co-axial B & W switches, 5 position, Model 590G **$24.00**

RAK L1 SWL trap antenna, 3-30 MHz ... **$15.90**

SWR METERS AND DUMMY LOADS

SWFS-2, single meter type, combined SWR and FS meter, 50 ohms, inc. FS pick-up whip, size 5" x 2" x 2¼". 3-150 MHz, UHF connectors ... **$15.00**

SWR-2, dual meters, 50 ohms. Simultaneous reading of forward and reflected power, 5" x 2" x 2¼". 3-150 MHz, UHF connectors ... **$22.00**

SWR-200 large dual meters, switched 50-75 ohms, with calibration chart for direct power readings to 2 kW in three ranges. A very elegant instrument. 7⅝" x 2¾" x 3¾", 200 MHz ... **$44.00**

KW ELECTRONICS Z Match Antenna Couplers 80 metres to 10 metres. Beautifully finished in communication grey (see review "QST" July, 1972):—

KW E-Zee Match, screw terminals at rear, size 5½" x 6" x 12", 30-2500 ohms, 400W ... **$67.80**

KW-107 Supermatch, as above but with addition of SWR meter, power meter with large 50 ohm dummy load to read up to 1 kW PEP, UHF sockets at rear. A superb piece of equipment, 7" x 8" x 13" ... **$187.50**

KW-109 high power version of KW-107, larger condenser coils ... **$218.00**

KW-160 "L" network single wire or co-ax. feed coupler especially for 160m. Also usable on 80 & 40 ... **$57.00**

KW-103 SWR Power Meter uses toroidal coil pick-up for continuous operation 52 ohms 1 kW max. to 30 MHz SO239 UHF sockets, very accurate ... **$49.00**

KW Dummy Load 52 ohm Air Cooled. Will handle up to 1 kW (ideal for use in the workshop or field) ... **$36.00**

HN31 Cantenna Kit 1 kW oil cooled (oil not included) **$26.00**

OTHER ACCESSORIES

AT-3 RF actuated CW Monitor and **Code Practice** Audio Osc. uses 4 transistors, 2 diodes, with built-in speaker and tone control.
Requires one UM3 penlite cell. In grey metal case, 2' x 3¼" x 3½" ... **$16.00**

EKM-1 Audio Morse CP Osc with speaker, one transistor. Headphone socket and tone control, requires one UM3 cell, in black metal case 3¼" x 3¼" x 1⅝" **$8.50**

AT-8 Audio Osc, larger de luxe type CP Audio Osc., 3 transistors. Includes relay for transmitter keying if required, and headphone socket. Tone and volume controls. Plenty of volume, suitable for group practice or tests. Nicely finished brown metal cabinet, 3¼" x 5" x 5". Requires four UM3 cells ... **$30.00**

MC-701 Mic. Compressor, battery operated. Available with 4 pin or TRS mic. connector, improved model **$39.50**

Yaesu YO-100 monitorscope, compatible with most other equipment. Includes IF for 3180 kHz (IF kits 455 kHz or 9 MHz, $9.00) ... **$192.00**

Yaesu YC-355D frequency counter, 200 MHz ... **$335.00**

MORSE KEYS

HK-708 light weight morse key suitable for practice or Tx use, flat style knob. Same mnfr. as HK-701 **$9.95**

EK-108 Electronic keyer, super quality, IC with dot memory. Built-in monitor & paddle. Solid state "relay". 230 V AC & 12 V DC types ... **$78.00**

HK-701 De luxe heavy duty morse key. Heavy base. A really beautifully constructed and finished unit. Fitted with a dust cover, standard knob and knob plate, ball bearing shaft ... **$20.00**

MK-701 Side Swiper key to actuate Electronic keyer **$24.50**

BK-100 (BUG) Semi-automatic bug key, full adjustable **$29.50**

NEW — VHF FM TRANSCEIVERS, 146 MHz
Arriving soon, a 25W 24 channel commercial quality set, superb construction in a compact metal case. Price approximately ... **$220.00**

Also a 10W 12 channel set at approximately ... **$175**

And, after many delays, some FT-220 due around end of April. Will include provision for operating FM repeaters. With extra crystal. Anticipated price ... **$475.00**

Also available: Equipment for novice, CB and Marine use on 11m band. Antennas, beams, Walkie Talkies, base stations, and accessories. Digital clocks.
Digital Clock BC/FM radios, Automatic VHF/UHF scanning receivers, SSTV, Generator noise filters.

Servicing facilities for all types of Amateur and Novice equipment. We check all sets before sale and provide a 90 day warranty.

All prices incl. S.T. Postage and freight extra. Prices and specifications subject to change without notice. Availability depends on stock position at time of ordering.

bail ELECTRONIC SERVICES 60 Shannon St., Box Hill North, Vic., 3129. Ph. 89-2213

QLD. MITCHELL RADIO CO., 59 Albion Road, Albion, 4010 Ph 57 6830
N.S.W. STEPHEN KUHL, P.O. Box 56, Mascot, 2020 Ph Day 667 1650 A.H. 371 5445
S.A. FARMERS RADIO PTY. LTD., 257 Angas Street, Adelaide, 5000 Ph 23 1288
W.A. H. R. PRIDE, 26 Lockhart Street, Como, 6152 Ph 60 4379

8400-8900 to 8700-9200 kHz. The resulting change in local-oscillator frequencies produced a heterodyne with the second harmonic of the 3180 IF in some units to produce the spurious output. This was eliminated by addition of the 6358.6 kHz crystal. All FTDX560s manufactured after introduction of the FTDX-570, and all FTDX570s have this circuit modification incorporated during production". ■

VHF UHF
an expanding world

with Eric Jamieson VK5LP

Forreston, S.A., 5233
Times: GMT

AMATEUR BAND BEACONS

VK0	VK0MA, Mawson	53.100
	VK0GR, Casey	53.200
VK1	VK1RTA, Canberra	144.475
VK2	VK2WI, Sydney	52.450
	VK2WI, Sydney	144.010
VK3	VK3RTG, Vermont	144.700
VK4	VK4RTL, Townsville	52.600
	VK4WI/1, Mt. Mowbullan	144.400
VK5	VK5VF, Mt. Lofty	53.000
	VK5VF, Mt. Lofty	144.800
VK6	VK6RTV, Perth	52.300
	VK6RTU, Kalgoorlie	52.350
	VK6RTW, Albany	52.950
	VK6RTW, Albany	144.500
	VK6RTV, Perth	145.000
VK7	VK7RTX, Devonport	144.900
P29	P29GA, Lae, Niugini	52.150
3D	3D3AA, Suva, Fiji	52.500
ZL1	ZL1VHF, Auckland	145.100
	ZL1VHW, Waikato	145.150
ZL2	ZL2VHF, Wellington	145.200
	ZL2VHP, Palmerston North	145.250
ZL3	ZL3VHF, Christchurch	145.300
ZL4	ZL4VHF, Dunedin	145.400

No alterations or additions to the beacon listings this month. Anyone in the know who can shed some light on the situation in regard to operation of the VK0 beacons could help me by confirming or denying the existence of the two beacons listed. Thank you.

SIX METRES

Although things have gone rather quiet (probably many ops writing up their Ross Hull Contests Logs!) there have been a number of openings to various parts of the country. Probably the best was on 9/2 when VK1, 2, 3, 4, 5, 7 and 8 plus ZL3 were worked at my QTH, and with a number of other stations joining in. The various VHF portable stations out for the John Moyle National Field Day would have had a ball considering the excellent conditions. After this the general decline set in, but for those operators with 144 MHz equipment, and following the activity around the start of February and its great DX, we now saw further . . . DX on 144 MHz and 432 MHz.

The excellent conditions prevailing since 31/1 continued on into February when on 4/2 Garry VK5ZK contacted Wally VK6WG on 432, crossband 432/144 with VK6BE. Wally VK6WG heard VK3ZDW and VK3ZFJ on 432, Bob VK6BE heard VK3AUU on 432, while Bob's total of contacts on 2 metres for the opening at this stage had risen to 98! A lull in proceedings started soon after this, but the 2 metre beacons in Adelaide and Albany were being watched very carefully.

The right conditions commenced building up on 15/2, with some contacts VK5 to VK6. However, 16/2 was the night. The sked on 40m. with Bob VK6BE confirmed something big for VK5 was coming up, and then it happened. 144 and 432 MHz both opened up with a vengeance, particularly into VK5 Adelaide area, Garry VK5ZK and Peter VK5ZPS wearing their voices out with a multitude of contacts to Albany. Garry was heard to remark at one time to the boys in Albany that there did not seem to be any more ways they could be worked on VHF; contacts had been two way 144 MHz, two-way 432 MHz, crossband 543/144, 146 FM both ways and crossband, all manner of antennas used, right down to whips etc. 5 x 9 signals both bands 144 and 432. From my location 50 km inland once more I had to sit on the fence and listen to those in Adelaide getting amongst it. Finally my turn came, albeit very brief, but at 1123Z on 16/2 I worked Wally VK6WG and nine minutes later Bernie VK6KJ. Soon after that the band closed for me again except for 4 minutes about an hour later when Wally VK6WG was again heard. Others to join in the general proceedings were VK5MT, VK5RO and most of the boys in the Mt. Gambier area.

Looking back on the 144 and 432 scene, one could have to say it has been a rather outstanding period. Excellent conditions coupled with generally very good equipment now in use has allowed better contacts to be made over a longer period, and this situation could well improve further when hopefully more 2 metre operators will start going tuneable, and the present tuneable operators go further up and include 432 in their range. Perhaps those further north in the eastern States do not share a great deal in this form of ducting and inversions, but may have some other worthwhile 2m and 432 contacts. Why not let me know and we will all hear about it!

EME CONTACTS

The moon has been bombarded with quite a few signals of late, and been returning them safely to earth as usual. On Saturday, 22/2, Ron VK3AKC heard WA6LET on 432 at 0730Z, report 429. Later at 1335Z Ron had a two-way contact on CW with PA0SSB, received 529, sent 539. PA0SSB was using a 24 foot dish to a UPX4 front end, transmitter a ringed amplifier using six 3CX100A5s with 1 kw input. 1430Z on 23/2 Ron contacted OZ9TR, O reports exchanged, similar Tx to PA0SSB but with a 28' dish. At 1525 Ron worked PA0SSB on CW, with O reports and rogers.

Chris VK5MC on 22/2 heard WA6LET, W6PO and VE2DFO on CW. Around 0640Z he heard these stations in contact with VE2DFO on SSB, on 144 MHz EME. To follow up, on 23/2 at 0738Z Chris worked K1WHS, sent 439, received 339. K2RTH slightly stronger, sent 449, rec. 439.

Tests on 22/2, 23/2, were facilitated because WA6LET had been able to use the 150 foot dish of the Stanford Research Institute. Schedules were arranged to call for the first 30 seconds of each minute during the time the moon would provide a window for both ends of the circuit. This commenced at 0640Z on 22/2 here and continued until after 0750Z, with elevations ranging from about 1 degree to 11.5 degrees, true north azimuth ranging from 58.9 to 48.7 degrees. Operating frequency 144.190 for calling and receiving about 144.120. This split frequency operation was necessary due to stations calling out of sequence and on the same frequency causing severe interference on previous occasions.

Chris VK5MC was good enough to pass on this information to Peter VK5ZPS who in turn passed it on to me. As I had never tried to listen for any EME signals from my home QTH, I thought nothing to lose by trying. Due to some miscalculations somewhere along the line the beam headings at this end were initially in the wrong place by about 10 degrees. When the moon finally became visible through the clouds corrections were made and lo! There were the signals from WA6LET. First signals were heard at 0750Z and copied at one minute intervals for 9 minutes until disappearing. These signals were recorded on tape as proof and were quite readable on the loudspeaker despite a high noise level emanating from the relatively wide-bandwidth of the SSB receiver, 2.3 kHz. Had a CW filter been available I am sure much more could have been heard. It goes to show that if there is enough power capability at one end to overcome most of the path losses, then reasonable equipment at the other end can complete the job, and I would be less than honest if I said other than it gave me quite a thrill to hear these signals so well. Now I wonder how much a 30 foot dish would cost . . . hmm? The XYL needs a fur coat first though!

2304 MHz RECORD

Alan VK3ZHU writes in a letter which was unfortunately mislaid, with details of a two-way contact between himself and Ian VK3ATY, on Mt. Cowley and Lake Mountain respectively, at 0130Z on 7/12/74. Reports, Alan received 5 x 6, sent 5 x 8. He suggests these are somewhat optimistic as calibrated pads indicated only readable 2-3 with 34 dB attenuation. Also readable 3 with VK3ATY transmitting on a ¼ wave whip — i.e. 1¼ inches long! — As a CW signal it was estimated it would have been an R5 signal with 40 dB attenuation. Equipment at VK3ZHU all solid state, BLY89 final on 144 MHz, MA4060 quadrupler to 576 MHz, SV220 quadrupler to 2304 MHz. Power out 2W. Slot-dipole-reflector used with a 4 foot parabolic reflector. Converter using 1N23F mixer to 144 MHz IF TIS88 converter to Barlow Wadley receiver (tuneable IF).

Equipment at VK3ATY identical except for 144 MHz exciter and QQE03/20 final, a valve tuneable IF. Liaison was via old Channel B crossband duplex operation (very helpful to optimise deviation and antenna alignment. Mode NBFM. Subject to verification and any other pending claims, this is probably a new Australian record. Estimated distance-209 km (130 miles). Further experiments will be made in 1975 when it is hoped to have at least a one-way contact on 3456 MHz, which awaits completion of final doubler 1728 to 3456 MHz.

Congratulations Alan and Ian, it was well worth the effort. Thank you for writing, and I know readers will be pleased to hear what you achieve in 1975.

VARIOUS JOTTINGS

David VK3AGB writes in a letter which also got missed, that he had a contact with VK4MM at Rockhampton at 0940Z in December using 10 watts of FM power into a "Ringo" antenna at 50 feet. He enquires if it has been bettered by anyone else for such low power and half wave aerial, distance about 2000 km (Warrnambool to Rockhampton) . . . I would think the contact between VK6BE and VK3BMD mentioned earlier would have to eclipse the above surely. The Victorian station was operating mobile in Melbourne using a ⅝ wavelength whip and 20 watts. That's a distance of some 2700 km, which is a very good effort. Thanks for writing anyway, David.

I must stress once again the necessity for sending any material for publication to REACH ME not later than the 28th of the month. I say this because I received quite a lot of information about a proposed portable expedition by Peter VK3ZAA, John VK3ATQ and Jan VK3ZUE for the 13th to 15th December 1974. This information did not get to me until 15th November, and copy for the December issue closed on 3rd Nov. Therefore, I could do nothing about publicising the expedition. Sorry chaps, you will just have to be earlier next time.

A letter from Gordon Featherstone, SWL40392, of Gladstone, Qld., advises of the death of Bob VK4ZAI, on 23/12/74. Bob was certainly well known in VK5, and we are sorry to learn of his passing. Gordon mentions that Bob had acquired new equipment for 6 and 2 metres not long before his death, and had logged a number of contacts in the Ross Hull Contest with the gear. Thanks for writing Gordon, and pleased to note you keep a close watch on six metres.

Wally VK2ZNW (ex VK5ZWW of meteor scatter fame) currently has no antennas erected whilst awaiting permission to stand up a tower to hold same. Wally now resides at Orange, and was heard a few times in VK5 on 6 metres. We in VK5 hope Wally will eventually put out a strong signal on 2 metres and 432 MHz for contacts this way — the distance is not much over 1000 km, not an impossible task. Let us know when you are ready, Wal.

New material which arrived at my desk recently was "APC", the newsletter of the Moorabbin & District Radio Club. Call sign VK3APC. A very well presented journal, the initial copy coming from Percy, VK3ZQP, Publicity Officer. I am hoping it will be a regular arrival in the future.

Roger VK2ZTB, Editor of "6 UP" when it was being produced, indicates he has a lot of original material on hand which could be of interest to readers. He is considering a proposal to present same in book form, at a reasonable price, as he believes the articles and information are too valuable to be gathering dust at his place. If you are interested why not write him a few lines and say so . . . to Roger Harrison, 47 Ballast Point Road, Birchgrove, NSW 2041.

Finally, the letter to me bearing news from the Publications Committee that I had been awarded the Higginbotham Award for 1974 came as a surprise, and a pleasant one at that. This award had never ever crossed my mind, but I am indeed

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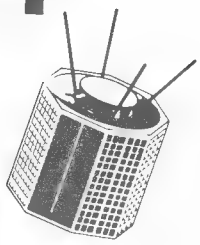

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Once attached to your H.F. equipment, you operate it exactly the same as on the H.F. bands, the Europa B does the rest.

The receive converter is broadbanded to cover the whole band without any tuning of the Europa B. It uses protected dual gate MOSFETs to give you optimum sensitivity, gain and minimum trouble from strong signals. In fact the H.F. receiver will normally overload before the Europa B does.

The transmit converter employs valves to provide, high power, good linearity and extraordinarily high rejection of spurious signals. This gives you a clean, sharp signal. The transmitter tuning is brought out to the front panel and requires retuning as you move around the band, in the same way as H.F. equipment requires tuning up.

The oscillator chain is a stable solid state circuit to ensure same frequency transceive operation, or correct netting with separates. The crystal used has a very high stability specification with only 5ppm tolerance.

* Dual gate MOSFETS in the receive converter.
* Bipolar transistors oscillator chain.
* Valves used in the transmit converter.
* Low receive noise figure - 2dB.
* Receive converter gain - 30dB.
* Transmit drive requirement, 200mW.
* Internal aerial change over relay included.
* Panel meter reads D.C. input and r.f. output.
* Power supply requirements:-
  1. 600-800V at 250mA.
  2. 300-360V at 70mA.
  3. Between -75 to -150V at 5mA.
  4. 12.6V ac or dc 1.8amp.
* A crystal switch and extra crystal can be fitted to extend the frequency coverage.
* High power - 200W maximum input 50% efficiency.
* Stable highly developed circuitry.
* Clean transmit output - 80dB except for harmonics of the fundamental.
* Attractive appearance, inside and outside, size only 9" x 4¾" front panel 4½" deep.

The Europa B plugs directly into the accessory socket of the FT101, FT227, FT200, FT250. Some older designs of YAESU equipment only have 6.3 volt A.C. available at the accessory socket (FT560, FT401, FL400, FL500). With these units a separate 12.6V supply must be provided for the Europa B.

Many people are using the Europa B with Heathkit.KW, Trio etc., equipment, we have the information on how to couple this to the Europa B.

TOTAL PRICE: $229 Road Freight $3.00. Available ex-stock, includes 90 day warranty.
Valves included: 2 off QQVO3/10/1 off QQVO6/40A.

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grateful to receive it, and makes me feel the efforts expended for so long have been worthwhile. Thank you, fellas!

I cannot, however, let the opportunity pass without again saying how much I appreciate receiving all those letters from all over Australia with news, notes, information for the VHF page, usually with a word of thanks for what is written into the column. The various Club Secretaries and Publicity Officers who send regularly copies of their magazines and journals for my perusal; without them news would be a bit scarce at times.

Therefore, it is really one big effort when you think about it — all who take the trouble to write to me share in the final set-up of our page, after all I only put it together, really. If you like to read our page, and find something of value in it from time to time, then I ask no more, I have received all the thanks I need.

Well, after all that, let's close with the thought for the month: "Love looks forward, hate looks back, anxiety has eyes all over its head".

The Voice in the Hills ■

Letters to the Editor

Any opinion expressed under this heading is the individual opinion of the writer and does not necessarily coincide with that of the Publishers.

The Editor,
Amateur Radio,
Dear Sir,

"An SL600 Series SSB Transceiver", by B. D. Comer, G3ZVC.

A small number of the transceivers built from the above article, which you published recently suffer from apparent AGC instability. The symptoms are generally motor-boating at certain signal levels.

The problem is not, in fact, due to the AGC but to instability caused by IF feedback through the unused transmitter section of the circuit. It may easily be cured by connecting a single 0.1 uF capacitor with low RF resistance between the transmitter section power supply rail and ground — as near as possible to the SL610C amplifier.

Installing this capacitor does not remove the necessity of grounding the transmitter power rail during reception and vice versa.

I apologise to anyone who has been inconvenienced by this fault but the majority of these transceivers are not affected and the problem has only recently been brought to my attention.

Brian D. Comer, G3ZVC

The Editor,
Amateur Radio,
Dear Sir,

We are pleased to inform you that the 5th SEANET Convention will be held in Kuala Lumpur 7-9th November 1975. Since we have been going for a rather long time then it might be time tell everyone who doesn't know what it is who we are.

SEANET AND SEANET CONVENTION

The South East Asia Net (SEANET) meets every day at 12.00 GMT on 14.320 kHz and is a very active net. 4S7PB Paddy is normally acting as net control but VQ9R Carl is also acting at times. Any station in Asia, Middle East, Pacific, may call in when respective call area is being announced by net control station. Other stations outside the mentioned call areas are called at the end of the net.

In order to get closer to each other every year we also have what we call the SEANET Convention. Previous conventions have been in Penang 1971, Bangkok 1972, Singapore 1973, Manila 1974. The convention for 1975 will be held in Kuala Lumpur 7-9th November.

The convention is informal and merely intended to meet hams from various countries. A club station with a special call sign is set up, and we will this year be operating from 9M2SEA. There is sometimes an exhibition of amateur equipment etc. In Singapore there was a film from the Spratly DX expedition by SEANET members and so on. The latest convention in Manila gathered around 125 people and hams from VK, YB, 9V1, 9M2, HS, XV5, W, JA, F and DU.

73,
Roland Fisk 9M2CJ for MARTS

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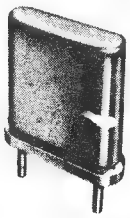

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The Editor,
Amateur Radio,
Dear Sir,

In reply to VK2AGZ regarding his comments of lament in the Letters column of the February AR, may I be permitted to clarify my position with Colin in that I am not one of those "one-eyed Labour Party Supporters" as he seems to think.

My condonation of the $12.00 licence fee had nothing whatsoever to do with party politics — no way — so where did I go wrong?

Yours faithfully
M. R. Morris L30134 ■

Awards Column

with BRIAN AUSTIN VK5CA
P.O Box 7A, Crafers, SA, 5152.

OE SERIES

General

1. Various awards are available to licensed amateurs and shortwave listeners.
2. Contacts on and after 1st April 1954 are valid with the exception of worked all OE/160 and heard all OE/160 where contacts on and after 19 February 1964 are valid.
3. Stations should submit a list certified by the Awards Manager of a National Society.
4. Awards are available for all CW, all Phone, 2 x SSB, 160 metres and mixed modes.
5. The fee for each award is 10 IRCs.
6. Address for aplications is:
   OeVSV
   Awards Manager
   Postfach 999
   A-1014 Vienna, Austria

Rules:

The same station may be worked on different bands for WAOE in the case of stations in Europe generally.

The same station may be worked twice on 160 metres provided that the contacts are at least one month apart.

Requirements:

WAOE — Stations outside Europe need one contact with any 8 of the 9 call areas.

WAOE/160 — Stations outside Europe require one contact with 4 call areas on 160 metres.

HAOE — This award is available to shortwave listeners who submit proof of having heard 8 of the 9 call areas.

HAOE/160 — This award is available to shortwave

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Philips Pocketbook 1974	**$2.75**
Electro-Optics Handbook (RCA)	**$6.40**
The Radio Amateur's Handbook (A.R.R.L.)	**$8.95**
IC Op-Amp Cookbook (Walter G. Jung)	**$14.90**
T.V. Fault Finding (Edited and Revised by J. R. Davies)	**$3.00**
The A.R.R.L. Antenna Book (A.R.R.L.)	**$5.10**
Transistor Substitution Handbook No. 14	**$3.25**
Electric Guitar Amplifier Handbook (Jack Darr)	**$7.65**
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Bandwidth	12 0 kHz	15.0 kHz	30.0 kHz	36 0 kHz	40.0 kHz	14.0 kHz	14.0 kHz
Pass Band Ripple	⩽ 2 dB					⩽ 1 dB	⩽ 2 dB
Insertion Loss	⩽ 3.5 dB	⩽ 3.5 dB	⩽ 4.5 dB	⩽ 4 5 dB	⩽ 4 5 dB	⩽ 3 dB	⩽ 1 5 dB
Input-Output Termination Z_t	820 Ω	910 Ω	2000 Ω	2700 Ω	3000 Ω	910 Ω	2500 Ω
Termination C_t	25 pF	25 pF	25 pF	25 pF	25 pF	35 pF	-
Shape Factor	(70 dB) 2 4	(70 dB) 2 3	(70 dB) 2.2	(70 dB) 1 9	(70 dB) 2 0	(40 dB) 3 0	(20 dB) 3.6
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WABP AWARD

General:

The award is available to licensed amateurs and shortwave listeners.

There is no date limit.

Do not send QSL cards. A list, showing full details of the contacts, should be certified by the Awards Manager of a National Society.

Any bands and modes may be used.

The fee for the award is 5 IRCs.

The address for applications is:

ON5TO
UBA Awards Manager
P.O. Box 634
Brussels, Belgium

Requirements:

Confirmed contacts are required with each of the 9 provinces on two bands.

List of Provinces:

WV — West Flanders; OV — East Flanders; AN — Antwerp; LM — Limburg; LG — Liege; LX — Luxembourg; NR — Namur; HT — Hainaut; BT — Brabant.

THE CYPRUS AWARD

The award is available to licensed amateurs.

Contacts on and after 1st May 1972 are valid.

Either log extract plus QSLs or a list of QSLs certified by the Awards Manager of a National Society should be submitted.

Contacts with both 5B4 and ZC4 stations are valid.

There are no mode endorsements.

The fee for the award is 10 IRCs or equivalent.

The address for applications is:

Awards Manager,
CARS
Post box 216
Famagusta, Cyprus

Requirements:

	MHz						
CQ Zone	1.8	3.5	7	14	21	28	144
	Points per contact						
20	4	2	1	1	2	4	16
1, 2, 3, 6, 7, 10, 12, 19, 24, 25, 26, 27, 29, 30, 31, 32	16	8	4	2	4	8	—
All other zones	8	4	2	1	2	4	16
Cyprus amateurs	4	2	1	1	2	4	8

Applicants outside Cyprus require 50 points if all contacts were on 1 band, 40 if on 2 bands, 30 on 3. ■

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EXAMINATION PAPERS: FEBRUARY 1975

TELEGRAPHY

SECTION L (Receiving)

(SPEED — 10 words per minute)

The 4 cylinder twin overhead
camshaft engine punches out a
very crisp 157 horsepower
it certainly mocks people who
think that fast acceleration
can only come from most 6 or 8
cylinder motors it makes 80
kilometres per hour in about 9
seconds and has completed the
standing kilometre from 32

SECTION L (Sending) — (Time allowed 2½ mins.)

An old newspaper account says
that 225 men 840 horses
and bullocks and about 130
camels were used for this work
great expanses of country did

SECTION M (Theory) — (Time allowed — 2½ hrs.)

NOTE: SEVEN questions only to be attempted. Credit will not be given for more than SEVEN answers. All questions carry equal marks.

1. (a) Explain the fundamental difference between frequency modulation and amplitude modulation.
   (b) With the aid of a circuit diagram, explain the theory of operation of the discriminator stage of a receiver suitable for reception of frequency modulated signals.
2. (a) Explain the theory of operation of a junction type transistor.
   (b) Draw a circuit diagram of a single stage audio amplifier in which use is made of a junction type transistor.
3. (a) Explain briefly the theory of radio transmission via the ionosphere.
   (b) Discuss the effects on high frequency transmission of the daily variations of the ionosphere, the seasonal changes and the eleven year sunspot cycle.
   (c) What is an "ionospheric prediction chart"?
4. (a) Using appropriate curves indicate the current and voltage distribution on a half-wave transmitting aerial (dipole).
   (b) Show whether even or odd quarter wave sections of resonant feeders are necessary to provide parallel tuning at the transmitter-end when the aerial is to be:
   (i) current fed;
   (ii) voltage fed.
5. (a) What is the essential difference between a "Tuned Radio Frequency" type of receiver and one of the "Superheterodyne" type?
   (b) Explain why an "image" signal can sometimes be received on a Superheterodyne type. Discuss means of reducing "image" effect.
6. (a) With the aid of a sketch, describe the construction and theory of operation of a crystal microphone.
   (b) Listing component values, show by means of a circuit diagram how this type of microphone is connected to an amplifier.
7. Explain the theory of operation of a "grid-dip" meter. Use diagrams to illustrate your answer. Give a practical example of the use of such an instrument.
8. (a) Show a circuit diagram of the final RF stage of a transmitter using a triode valve, and state step by step how you would neutralise it.
   (b) What effects could result from operating such an amplifier which was not neutralised? Explain.
9. Two resistors, R1 and R2, of 20,000 and 10,000 ohms respectively are connected in series across a 20 volt DC supply of negligible impedance. Calculate:
   (i) the potential difference across each resistor;
   (ii) the power dissipated by R2;
   (iii) the voltage reading which will be obtained if a voltmeter having an internal resistance of 10,000 ohms is connected across R1.

SECTION K (Regulations) — (Time allowed 30 minutes)

NOTE: THREE questions only to be attempted. Credit will not be given for more than THREE answers. All questions carry equal marks.

1. (a) What precautions should be taken by the operator of an amateur station before he commences to transmit?
   (b) During the period of working with another station or stations what procedure must be adopted concerning announcement of call-signs?
2. (a) State the maximum power which may be used in an amateur wireless station using:
   (i) amplitude-modulated double sideband emissions (A3);
   (ii) single-sideband suppress-carrier emissions (A3J).
   (b) In each case, indicate where the power should be measured.
3. (a) What is meant by a "third party" message?
   (b) State the requirements of the regulations in regard to the handling of "third party" messages by licensees of amateur wireless stations.
4. Give the meaning of the following abbreviations:
   QSA? QRG QSB? AS QRV? ■

DIVISIONAL BROADCASTS

Do you have the time and want to keep in touch with events? If so here are the latest details available of Divisional broadcasts.

VK1WI

Sundays 10.00 Z —
3595 kHz
27125 kHz AM
146.5 MHz FM
BC Committee VK1VP, IMP, 2YS/1.

VK2AWI

11.00 local time Sundays:
3595 kHz AM
7146 kHz SSB
52.525 MHz FM
53.866 MHz AM
145.13 MHz AM
146.00 FM
Hunter Branch Mondays 19.00h 80m.

VK3WI

10.30 local time Sundays:
1825 kHz AM
3600 kHz SSB
7146 kHz SSB
144.5 MHz AM
Ch1 FM
(subject to availability at present of relay stations whilst under re-location).

VK4WI

09.00 local time Sundays:
3580 kHz AM
7146 kHz SSB
14342 kHz SSB
re-broadcast on Ch B FM. BC officer VK4HB.

VK5WI

23.30Z Sunday mornings originating on 1.8 MHz band and relays as follows—
3.615 MHz by VK5ZQ
7.125 MHz by VK5NB
14.170 MHz by VK5TY
52.2 MHz by VK5ZEG
Channel 4 Repeater, Adelaide
VK5DK in Mt. Gambier on 2m FM

VK6WI

09.30 local time on Sundays:
3600 kHz SSB
7080 kHz SSB
14100 kHz SSB
52.656 MHz FM

VK7

09.30 local time on Sundays originated on Mt. Barrow 2m repeater VK7RAA and re-broadcast in Launceston area 3672 kHz SSB, 7130 kHz AM and in Hobart area on 53.032 AM, 144.1 MHz AM, 146 MHz FM and 432.1 MHz AM. ■

QSP

COMMUNICATIONS

"The Australian P.M.G. has announced that the APO will commission an integrated series of social research projects over the next two years to study how new technologies could affect the way we live. They will focus on three basic questions concerning the current and future relationship between Australian Society and its "nervous system" — the national telecommunications network. The questions relate to social trends (A. Nat. Uni. team under Dr. F. Emery), the information industry (computers, etc.) and telecommunications and transportation". Adaptation from article in ITU's Telecommunication Journal of Nov. '74. ■

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Take the hard work out of Coil Winding, use — "WILLIS" AIR-WOUND INDUCTANCES

No	Dia Inch	Turns per Inch	L'gth Inch	B & W. Equiv	Price
1-08	1/4	8	3	No 3002	88c
1-16	1/2	16	3	No. 3002	88c
2-08	5/8	8	3	No 3006	$1.06
2-16	5/8	16	3	No. 3007	$1.06
3-08	3/4	8	3	No. 3010	$1.28
3-16	3/4	16	3	No. 3011	$1.28
4-08	1	8	3	No. 3014	$1.42
4-16	1	16	3	No. 3015	$1.42
5-08	1 1/4	8	4	No 3018	$1.58
5-16	1 1/4	16	4	No 3019	$1.58
8-10	2	10	4	No. 3907	$2.29

Special Antenna All-Band Tuner Inductance
(equivalent to B & W No 3907 7 inch)

7" length, 2" dia., 10 T.P.I. **Price $3.96**

Reference: A.R.R.L. Handbook, 1961
Stockist of Transmission Cables, Insulators and Hard Drawn Copper Antenna Wire
Write for range of Transmission Cables

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PTY LTD
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TO ALL READERS

FROM

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OF JAPAN

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S. HASEGAWA
President
YAESU MUSEN CO. LTD.
JAPAN

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that gives you the world and an FM option, too.

All-band/all-mode reception on frequencies 170 kHz to 30 mHz covered by 6 bands. Receives broadcasts in any mode AM, SSB, CW or FM—with the optional accessory QR6-FM. Super sensitivity from dual gate MOS types FET's, double signal selectivity and AGC characteristics. IF circuit with mechanical and ceramic filters designed for high selectivity, resistance to interference; single button selection of wide band (5 kHz/6dB) or narrow band 2.5 kHz/6dB). Altogether a high performance compact, smartly styled unit of advanced design at a suggested 'Today' price of **$332.20**

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Contests

with Jim Payne, VK3AZT
Federal Contest Manager,
Box 67, East Melbourne, Vic., 3002

NOTES ON THE ROSS HULL VHF-UHF MEMORIAL CONTEST 1974-75

Again it is congratulations to Kerry for a very good win and also to Trevor VK5NC for his fine effort in the 48 hour section. Only 20 logs were received for this Contest and the winning scores indicate the extend of the reduced activity. Last year the top scores for the 7 day and 48 hour divisions were 7300 and 2211. However, Kerry scored his win last year from 1008 contacts with 252 different stations. This time he worked 218 different stations for 622 contacts.

The modes used by stations **received** by Kerry during the last 3 contests were:—

	1972/73 %	1973/74 %	1974/75 %
SSB	52	70	78
FM	30	24.5	19.7
AM	17.9	5.4	1.9
CW ..	.05	.08	0.3

Kerry also commented that the trend in operating modes is now almost 100% SSB on the tuneable section of 52 MHz and two metres DX.

The highest scoring contacts recorded in the logs received were claimed by Trevor, VK5NC for 2 contacts with 6KJ and one with 6BE when using 10 watts SSB on 144 MHz on 20th Dec 1974. These were worth 125 points each. Kevin, 3AUQ worked 3ZBJ over 125 kilometres using FM on 1296 MHz on 8th Jan and repeated the effort on 11th Jan using cross mode CW/SSB. These contacts were worth 50 points each. The following contacts on 144/146 MHz were scored at 75 points:—

21.12.74 VK5SU to 2ZAY, 2ZCV, 2ATI/M2, 2YBZ/M2
VK5ZTT/T to 4UX, 4MM, 4NY, 4QB.

All those contacts were made around 0220 GMT.

CONTEST COMMENTS

Again this year there are a number of requests for use of GMT wholly, that is start and finish on GMT days as well as use GMT. Kevin, 3AUQ referred to GMT and concluded with "otherwise not a bad contest, in spite of lack of DX openings". Trevor, 5NC commented, "A most enjoyable contest. I thoroughly enjoyed it and only operated on 144 MHz. Had over 300 contacts — Sorry I have not enclosed my full log — too much writing (Hi)". VK7ZAH commented, "A friendly and most enjoyable contest as usual. Unfortunately band conditions were not as good as in past years". Harold VK4DO suggests "that distances be calculated from state to state with points awarded accordingly for respective distances". Murray 5ZMM wrote "If we are to log times in GMT it is logical to use GMT days and not EAST calendar days as required. Experience at this QTH indicates that propagation tends to keep GMT days".

Mark 6ZGZ commented "Friendly contest again this year with all stations giving information on equipment, QTH, etc. Lousy DX season in Perth. Did better last year running xtal locked AM than this year's VFO SSB". The only entrant in the CW section, Russ VK4XA wrote "Activity appeared to be down on last contest when I participated as VK3KX". And the last word goes to 2HZ, "Conditions were poor compared with last year — appeared to be reduced activity also".

CONTEST CALENDAR

April

5/6	Polish CW DX
12/13	Swiss (H-22)
19/20	Bermuda phone
19/20	WAEDC RTTY
26/27	PACC Phone/CW

May

3/4	Bermuda CW
10	World Telecomm phone
11	Worked all Britain (LF Phone)
17	World Telecomm CW

POLISH CW DX CONTEST

Starts 1500 GMT Sat Apr 5. Ends 2400 GMT Apr 6.

The world working SPs 3.5 thru 28 MHz. Single op, single and all band, multi-op all band. SWLs also. Send usual RST and receive RST plus letters (powiat letter). Each SP QSO 3 points with multiplier for each powiat (once only). Separate sheet for each band, summary sheet and declaration. Mailing deadline April 30th to PZK Contest, Box 320, 00-950, Warszawa, Poland.

SWISS H22 CONTEST

Many of the rare cantons are activated for this contest offering an excellent opportunity for the attractive H-22 certificate. All bands 1.8 thru 28 MHz. Phone and CW. The same station may be worked on each band for QSO and multiplier credit but only on one mode. Usual RST, Swiss stations will include their canton. These are AG, AR, BE, BS, FR, GE, GL, GR, LU, NE, NW, SG, SH, SO, SZ, TG, TI, UR, VD, VS, ZG, ZH. Each QSO counts 3 points. The multiplier is the sum of the cantons worked on each band, a possible of 22 on each band. Final score is QSO points by sum of cantons from all bands. Mail log within 30 days to USKA Traffic Manager, HB9AHA, im Moos, 5707, Seengen, Switzerland.

Please send SASE to FCM for full details of contests listed for May. ■

RESULTS OF THE 1974-75 ROSS HULL VHF-UHF MEMORIAL CONTEST

FOURTH TIME IN A ROW FOR VK5SU

Trophy winner — VK5SU J. W. K. Adams
48 hour certificate — VK5NC T. Niven

Detailed scores: first column 7 day; second column 48 hour.

Section (A) Transmitting Open		
VK5SU	3570	943
VK3AUQ	2009	787
VK4DT	798	241
VK2HZ	—	272
Section (B) Transmitting Phone		
VK5NC	2494	1146
VK7ZAH	2041	829
VK4DO	1985	714
VK6ZKO/T	1931	1056
VK5LP	1226	370
VK1VP	1194	515
VK5ZTT/T	1042	328
VK5ZMM	670	300
VK6ZGZ	618	341
VK3KK	464	292
VK8ZGF	450	—
VK5ZDG	291	—
VK3ASV	186	—
VK2ZCT/T	178	126
Section (C) Transmitting CW		
VK4XA	200	55
Section (D) Receiving		
L2074, J. M. Hilliard	507	—

■

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With Syd Clark, VK3ASC

BREAK-IN November 1974
Slow Scan Television; The Restless Atmosphere; ZL1BKB Wideband Dipole Antenna; An Electronic Thermometer; Two Cheap and Easy Regulated Power Supplies; Radio Expo '74.

December 1974
A Direct Conversion Receiver; Automotive Interference Suppression; Improving Your FT200; Amsat-Oscar 7.

CQ September 1974
An SSTV Keyboard; Short-Term Predictions for Ionospheric Propagation; QRP (Feature).

November 1974
Impedance Measurements at Radio Frequencies; CQ World-Wide DX Contest; Visiting the Balkan Hams.

HAM RADIO November 1974
Low Power CW Transceiver; Scattering Characteristics of Artificial Radio Aurora; VHF FM Channel Scanner; Measuring Peak Envelope Power; Harmonic Prediction; The Code Mill; Automatic Phone Controller for Repeaters; Tuneable Low-Frequency Converter; Solar Power.

QST November 1974
A Two-Band Delta-Loop Array for Oscar; Digital Clocks for the Amateur Station; More Basics of Solid-State Transmitter Design; Communicating at VHF via Artificial Radio Aurora; A QRP Solar-Cell Supply; Antenna Performance Measurements; ARRL 10 & 160 metre contest announcements.

December 1974
Another Look at Reflections, Part VI; The Minooka Special; The RYer; The Tower-Guard System; A One-KW Linear Amplifier Using Four 811As; VHF Antenna Arrays for High Performance; Some leads on Antenna Couplers.

January 1975
Practical Ideas for the ATV Enthusiast, Part 1; An Integrated Keyer/TR Switch; An Inexpensive Low Noise Preamplifier for 432 MHz; A Simple Fixed-Direction Quad; Frequency Counter-A Modular Approach; 100 Watts PEP Output with Power Transistors; The Octopus; A No-Junkbox Regulated Power Supply; Annual ARRL Novice Roundup Announcement; On Handling Public Service Traffic; Recent Equipment: The HAL DKB-2010 Dual Mode Keyboard and Regency HR-6 FM Transceiver.

RADIO COMMUNICATION November 1974
A 2m Helical Aerial for Satellite Communications; The Oscar File; Injection Locking of Reflex-Klystron Oscillators; 4m SSB from a Pye Ranger; A Balun Transformer for 50 and 75 ohm Lines.

The Cambridge on 2m; An Outline of Pulse Code Modulation; An Integrated Circuit Two-Tone Generator; A Converter for the 432 MHz Band.

SHORTWAVE MAGAZINE September 1974
Getting Going on 23 Centimetres; Transistor Cascode Amplifier; Easy Top Band Vertical; Ground Plane for Two; Booster for the FDK Multi-2000.

RADIO ZS November 1974
Oscar-EME Working Group and area notes only.

73 October
The FCC As Seen By W6EIF; Introduction to Micro Transistors; Build a 2m Frequency Synthesizer; Repeater Government Guide; The Heath HWA202-1; Simple Power Supply for Digital Work; The Wet Net; The GDO the VOM & XYL; Selective Calling; Removable VHF/UHF Mobile Antennas; Two-Metre Types You Have Met; How to Win Friends and Influence the 2m Man; AM or FM Inputs; Another Look at Vertical Waterpipe Antennas for 2m; Adjusting FM Deviation; A 146 MHz Mobile Antenna; Miniboxing the 1.65 MHz IF; Hold on to that Rig; It's a Call; Moskey; Oscar 7 with a Receiver; High Output Accessory Mic; A High Power Low Pass Filter; It was a Bench Job; Ham Radio & Foreign Languages; Simple Six Pre-Amp; The Three Wire Dipole; Loading up for Optimum Anode Current or RF Output; A Digital Interlaced Sync Generator for Closed Circuit TV; Notes on Converting the AC/DC for WWV; Electric Extension Cords; Longer Tube Life with the NCX-5.

November 1974
Dipole Antenna Tuning; Latest Counter Update; Who Needs a 5V Supply; How to Win a Big Contest; Digital Wind Direction Indicator; Build a 2m Frequency Sythesiser; Experiment in Terror; A Wind-Proof 20m Beam; Tones and How to Touch Them; The Double Stub Matching System; How You can Teach Novices; Build This Digital SWR Computer; A Real Hot Front End for Six; Build a Basic Bridge; Moskey, Part 3; August 73 Conveter Update; Beep-Beep-Beep, You're High; What's Really Inside the Regency HT; Would You Believe 187,000 Phone Patches.

December 1974
Making Nicads Behave; Zillions of Parts for Nothing; C31 or Bust; Wind Indicator for Your Shack; Modified Weather Satellite; A Logical Keyer; The Perils of Novicehood; Can FM Simplex be Solved; Meters and Their Faces; Slow Scan Tape Secrets; Simple Probe Logic Check; Public Service Band Converter; Tuned Diode VHF Receivers; Automatic SWR Computer Part 2; El Cheapo Tower; Hamshack Goodies; Hamfest Wheeling and Dealing; Rhombics and Their Worth; DX Chasing; Heathkit GR-78. ■

20 Years Ago

with Ron Fisher VK3OM

APRIL 1955

April 1955 was one of the first 'special issues' devoted to one particular aspect of amateur radio. This one was for VHF. Gordon Bowen VK5XU presented two antenna articles. The first was the 'Skeleton Slot' Antenna. Gordon told of its history, development and then described construction and feed methods. His next article Twin Lead 'Sprigs' told how a single 300 ohm feeder could be used to feed two antennas, one on 144 MHz and one on 50 MHz. A series of quarter wave stubs were used to isolate the two antennas.

Back to 'Skeleton Slots this time with Don Knock VK2NO. Don described how he went about building the slot, finishing up with some thoughts on using it on lower frequency bands.

Receiver noise has always been a problem on VHF. The goal always a better RF stage; Fred Bail VK3YS decided that the one for him was a push-pull 6J6. Full construction information was given plus the circuit of a follow-up mixer oscillator also using a 6J6. An article reprinted from CQ, "The Silicon Crystal Noise Generator", by William Orr, W6SAI. The construction and use of this simple device was explained in Bill Orr's usual manner.

"Max Howden VK3BQ". A word picture of this pioneer amateur and the equipment he was using on VHF at that time was given by Jack Duncan VK3VZ. Max of course is still going strong and still an active amateur.

On the Federal front, a report indicated that steps were well in hand towards the formation of the Papua and New Guinea division of the WIA.

The DX page reports that conditions were on the up-grade. There was even a report of a W6 being heard on 28 MHz. However many good contacts were to be had on 15 and 20. ■

REPEATER CALL SIGNS

In letter RB4/4/23 of 9th January 1975 the APO confirm that the callsign block RAA to RZZ (preceded by VK plus appropriate State numeral) is reserved for use by amateur repeater and beacon stations. It seems that the blocks RSA to RSZ and RTA to RTZ have been retained for beacons but clarification on this is still awaited.

GEELONG HAMFEST

WEEKEND OF

26th & 27th APRIL 1975

EVENTS INCLUDE:—

- ☐ **CAR PHONE CHECKS**
- ☐ **TRANSMITTER HUNTS**
- ☐ **SCRAMBLES**
- ☐ **DISPOSALS SALE**

Further Details from

WIA BROADCASTS

or from

DAVID FARQUHARSON VK3ZOQ

PO Box 520, Geelong, 3220

Teleprinters and associated equipment wanted by Australian Amateur Radio Teleprinters Group. If you have a teleprinter not being used, why not dispose of it through our Group to someone anxiously waiting to get started on RTTY. Particulars and price to: Secretary, WIA, WA Division (AARTG), Box N1002, GPO, Perth, WA 6001.

Hamads

- Eight lines free to all W.I.A. members. $6 per 3 cms. for other amateurs and S.W.L.'s.
- Copy should be in block letters or typescript, signed and forwarded to The Editor, P.O. Box 150, Toorak, Vic., 3142.
- Excludes commercial advertising.
- Closing date for Hamads is the 3rd day of the month preceding publication.
- QTHR means the advertiser's name and address are correct in the current Australian Callbook.

FOR SALE

Heathkit HW22, Dynalab tri-banded for 80, 40 and 20 metres, complete with AC PSU and speaker, two 12V DC supplies, mic., mobile mount, spare final tubes, manuals. $125. VK3ARZ, 12 Explorers Crt., Vermont South 3133. Ph. (03) 232-9492.

455 kHz Mechanical Filters: Toyo CM, 2.4 kHz bandpass, $20; Kokosai 2.7 kHz with data sheet, $17.50; Collins 3.1 kHz with data book, $17.50. VK3ARZ, 12 Explorers Court, Vermont South, 3133. Ph. (03) 232-9492.

Rack 4 ft., $5.00; **Frequency Counter,** 1 H.P., 524B, 20 CPS 100 MCS, $198.00; **STC High Band Mobiles,** 4 MTR 25/121; **STC Low Band Mobiles,** 2 MTR 25/11, $25.00 each; **2m FM Unit,** solid state home brew, going $100. VK3YDB, QTHR. Ph.: (03) 91-3905.

GEC 1 x 4 high band repeater system, $30.000; **Low Band** MR10, $10.00; **AWA** deviation meter, 40 to 170 MCS, $60.00; **B47,** 6m tuneable transceiver (FM), $35.00; **Palec** sig. gen. SG1, $20.00; **CRO** Cosser, 1049, dual beam final CTT HT transformer U/S, $30.00; plus assorted other bits and pieces. Having general clean-out, VK3YDB, QTHR. Ph.: (03) 91-3905.

Eddystone 830/7 receiver, 300 KC/S — 30 MHz continuous coverage, perfect condition, recently overhauled, $450.00, manual and spare valves. J. V. Hitch, 37 Harding Street, Portarlington, Vic. 3223.

AWA BS-50D base station with RC-1A remote control unit. Unmodified lo-band in good working condition. Ex QATB $50.00 ONO or exchange for SSTV components. VK4ZKI, QTHR. Ph. (072) 76-1284.

FT75 Solid State HF transceiver, including AC power pack, DC power pack and VFO. Worth $500 — sell $350 ONO. Peter Cossins VK3BFG, QTHR. Ph. (03) 231-2778.

Solid Fibreglass Rods 9/16" to ¼", 10 feet long, $5; BC 221 Frequency Meter, $30; Command Tx 3.5 MC CW, $10, will accept nearest offers. C/- Box 279 Nambour, Q. 4560.

Rack 6 ft high, incorporating 2 Mx FM Base and 6 Mx FM Base, both AWA and with 6-40 finals. Also HF Linear Amp, legal limit for 80-40-20 Mx, including power supplies for the above. Price $350 ONO. P. Milne VK3BEJ, Box 30, Mildura, Vic. 3500. Ph. (050) 24-5814.

Yaesu FL2100 linear amplifier, as new, in original packing, $390. VK3VF, QTHR. Ph. (03) 64-0661, ext. 595 Bus.; (03) 723-3554 A.H.

FTV-650 6m transvertor, complete with all cables and instruction book, and spare 6146 final. All new. $175.00, or will exchange for FT-75 Transceiver, cash adjustment. Claud Singleton, VK4UX, QTHR.

2 Vintage Receivers ATR-2C. ex RAAF. 1 near orig. & going. 1¾ converted to 160 Mx. CCT supplied. $35 each. 1 power supply for same in mint cond. $30. Sold if both Xceivers sold. Offers? Aileron cable heavy duty for guys. 10c yd. VHF pre-amp. Commercial valve type with p/s. $10. Power Xformer 750-750 at 2 amps, $30, offer? VK3WW, QTHR. Ph. (03) 465-2991.

Shack Clean-out. Collins 75S3B, late model, mint, $525; Yaesu FT2FB, 8 channels, as new, $185; Pye overland, solid state, valve PA 2 FM 1, 4, 40 & 50, $125; Trio 9R59DS, very good, $125. VK3OM. Phone (03) 560-9215.

WANTED

FT200 and matching PS or similar transceiver. VK3OM, QTHR. Phone (03) 560-9215.

Unused Spare Valves, Swan 350 transceiver, including matched pair 6HF6s. Prices: L. Peasley, VK2BLP. 53 Iris St., Moree NSW. Ph. (067) 52-2172.

Silent Keys

It is with deep regret that we record the passing of—

Mr. A. WILLIAMSON	L30304
Mr. E. N. STEET	L30200
Mr. F. R. WHITFIELD	VK6XF

PROJECT AUSTRALIS

Reference Orbits for April & May, 1975. Code: Date, Orbit No., time Z and degrees west, of Equator crossing of first orbit of GMT day.

OSCAR 6

APRIL			
1	11237	103.07	63.1
2	11249	3.00	48.1
3	11262	57.93	61.9
4	11275	152.85	75.6
5	11287	52.79	60.6
6	11300	147.71	74.3
7	11312	47.65	59.3
8	11325	142.57	73.0
9	11337	42.51	58.0
10	11350	137.43	71.7
11	11362	37,36	56.7
12	11375	132.29	70.4
13	11387	32.22	55.4
14	11400	127.15	69.2
15	11412	27.08	54.1
16	11425	122.01	67.9
17	11437	21.94	52.8
18	11450	116.87	66.6
19	11462	16.80	51.6
20	11475	111.73	65.3
21	11487	11.66	50.3
22	11500	106.59	64.0
23	11512	6.52	49.0
24	11525	101.45	62.7
25	11537	1.38	47.7
26	11550	56.31	61.4
27	11563	151.24	75.2
28	11575	51.17	60.1
29	11588	146.10	73.9
30	11600	46.03	58.9
MAY			
1	11613	140.96	72.6
2	11625	40.89	57.6
3	11638	135.82	71.3
4	11650	35.75	56.3
5	11663	130.68	70.0
6	11675	30.61	55.0
7	11688	125.54	68.7
8	11700	25.47	53.7
9	11713	120.40	67.4
10	11725	20.33	52.4
11	11738	115.26	66.1
12	11750	15.19	51.1
13	11763	110.12	64.9
14	11775	10.05	49.8
15	11788	104.97	63.6
16	11800	4.91	48.6
17	11813	59.83	62.3
18	11826	154.76	76.0
19	11838	54.69	61.0
20	11851	149.62	74.7
21	11863	49.55	59.7
22	11876	144.48	73.4
23	11888	44.41	58.4
24	11901	139.34	72.2
25	11913	39.27	57.1
26	11926	134.20	70.9
27	11938	34.13	55.8
28	11951	129.06	69.6
29	11963	28.99	54.6
30	11976	123.92	68.3
31	11988	23.85	53.3

OSCAR 7

APRIL			
1	1708	26.80	56.3
2	1721	121.08	69.9
3	1733	20.42	54.7
4	1746	114.70	68.3
5	1758	14.04	53.1
6	1771	108.32	66.7
7	1783	7.66	51.5
8	1796	101.94	65.1
9	1808	1.28	49.9
10	1821	55.56	63.5
11	1834	149.84	77.1
12	1846	49.18	6[illegible]
13	1859	143.46	75.[illegible]
14	1871	42.80	60.3
15	1884	137.08	73.9
16	1896	36.42	58.7
17	1909	130.70	72.3
18	1921	30.04	57.1
19	1934	124.32	70.7
20	1946	23.66	55.5
21	1959	117.94	69.1
22	1971	17.28	53.9
23	1984	111.56	67.5
24	1996	10.90	52.3
25	2009	105.18	65.9
26	2021	4.52	50.7
27	2034	58.80	64.3
28	2047	153.08	77.8
29	2059	52.42	62.7
30	2072	146.70	76.2
MAY			
1	2085	240.98	89.8
2	2097	140.32	74.6
3	2109	39.66	59.5
4	2122	133.94	73.0
5	2134	33.28	57.9
6	2147	127.56	71.4
7	2159	26.90	56.3
8	2172	121.18	69.8
9	2184	20.52	54.7
10	2197	114.80	68.2
11	2209	14.14	53.1
12	2222	108.42	66[illegible]
13	2234	7.76	5[illegible]
14	2247	102.04	65.0
15	2259	1.38	49.9
16	2272	55.66	63.4
17	2285	149.94	77.0
18	2297	49.28	61.8
19	2310	143.56	75.4
20	2322	42.90	60.2
21	2335	137.18	73.8
22	2347	36.52	58.6
23	2360	130.80	72.2
24	2372	30.14	57.0
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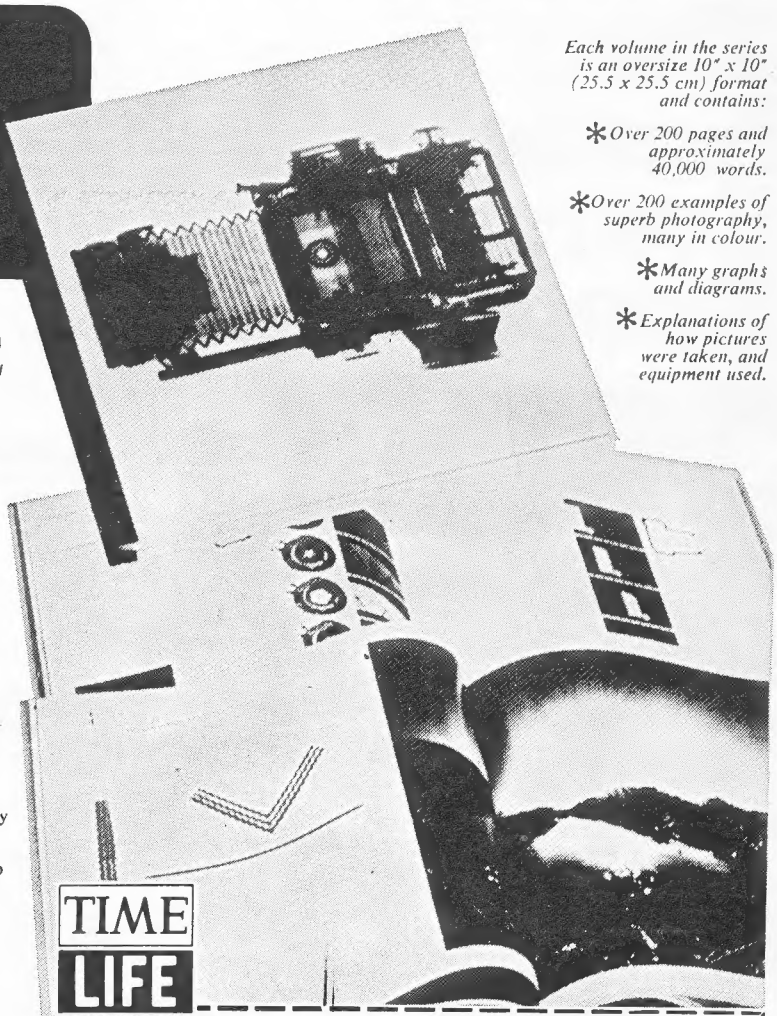

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